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ABSTRACT

A study was conducted of Tanzanian adolescent school children's responses to filmic elements. The design included a very large sample in a complicated factorial design, varying such factors as color, type of action, background and sound of the film, and the demographic characteristics of the subjects. Results showed that of these variables, comprehension was better when live action, and plain background were used, when subjects were from rural schools but with urban-experience, and when subjects had more experience in seeing films. No other significant differences were found. (SH)

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YOUNG TANZANIANS AND THE CINEMA:

A STUDY OF THE EFFECTS OF SELECTED BASIC MOTION PICTURE ELEMENTS AND POPULATION CHARACTERISTICS ON FILMIC COMPREHENSION OF TANZANIAN ADOLESCENT PRIMARY SCHOOL CHILDREN

by

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M.S., Syracuse University, 1966

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DISSERTATION

Submitted in partial fulfillment of the requirements for
the degree of Doctor of Philosophy in Education in the
Graduate School of Syracuse University, March, 1973

Approved________________________

Date________________________

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DEDICATION

This study is dedicated to President
Julius K. Nyerere and the young people
of the United Republic of Tanzania

Preface

A Tanzanian familiar with the United States and its strange breed of humanity once remarked to me, "You Americans look at everything as if it were a problem to be solved." While outwardly enthusiastic about the topic of this study, I was inwardly uneasy about assimilating the motion picture and the young people of Tanzania into "a problem". Both the cinema and Tanzania evoke feelings inside me which defy the kinds of objective scrutiny which my scientific background sees as desirable. But further understanding of each has increased my respect for the mystery of both. I hope that the numbers in the 33 tables serve to widen the knowledge of how Tanzanians derive pleasure and meaning from the motion picture. My ultimate goal was to illuminate and encourage and not merely to solve a problem.

Many who happen across this study will probably not care about the details required in reporting a scientific investigation. While I have not included a summary aimed at the film user (teacher, extension worker, etc.) or the filmmaker, Chapter 5 does speak more directly than other chapters of the main text to the practical implications of the research. Appendix 4 is directly aimed at those who must deal with filmmaking and film projection under difficult financial and practical conditions.

I am grateful to many who directly gave assistance and encouragement. The initial design was developed in a seminar chaired by Dr. Marshall Segall. His insights, suggestions, and patience throughout the study came as both teacher and friend. My other committee members, Drs. John Tyo, Donald Ely, and Kenneth Fishell, provided the encouragement and freedom which allowed an unorthodox and unfashionable topic to sprout. And to pay for most of the bills, the Foreign Area Fellowship Program went out on a limb to provide generous support. Nancy Jane Godfrey read and helpfully criticized the statistical portions. The views and findings of the study are wholly mine and not necessarily theirs.

The various officials at the Ministry of Education, the University of Dar es Salaam, and the Institute of Education, while often skeptical, nevertheless provided assistance at crucial times. I am particularly appreciative of the cooperation of the head teachers, teachers, and pupils in the 16 schools visited in the course of the study. Their response indicated the whole thing was worthwhile.

The interest and hospitality of Shirin and Noorali Velji and Vadan Majithia and his family has spanned continents and years. Their friendship has been a source of great comfort, particularly during my stay in Dar es Salaam.

Two other friends, who also happen to be my mother and wife, have shared the burden which was part of this work. The editing and mind-numbing typing were done by my wife Peggy. Her tolerance in the face of provocation is deeply appreciated. My mother, Ruby Landry, provided a source of steady love despite many adversities. My brother Dan, his wife, and children completed the sense of family which became important after the death of my father. To this hardy little band, I acknowledge my gratitude for their love and affection.

Beyond those listed above, many people have contributed to the skills and state of mind which helped bring this study to completion. At the grave risk of omission, the following provided skills as well as spiritual and emotional support--and more often than not, physical sustenance to meet a hungry student's practical needs. This is the rare moment in my life when it is possible to publicly declare my debt to them individually and to let them be representatives of others not listed.

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TABLE OF CONTENTS

Page

PREFACE iii

LIST OF TABLES viii

LIST OF ILLUSTRATIONS x

Chapter

1. INTRODUCTION 1

   Rationale for Selecting Tanzania
   Purpose and Problem
   Definitions
   Research in Developing Nations
   Taxonomic Specification of Study

2. RELEVANT LITERATURE 11

   Chroma: Color vs. Black and White
   Camera Mode: Animation vs. Live Action
   Visual Context: Plain vs. Complex Background
   Audio: Silent vs. Sound
   Viewer Characteristics: General Discussion
   Viewer Characteristics: Rural vs. Urban
   Viewer Characteristics: Male vs. Female
   Viewer Characteristics: Age Level
   Viewer Characteristics: Prior Film Viewing Experience
   Methodological Considerations

3. METHODS AND PROCEDURES 49

   Hypotheses
   Research Design
   Subjects
   Tribal and Ethnic Origin
   Preparation of Stimulus Material
   Instrument
   Equipment for Field Testing
   Questionnaire Administration
   Task Training
   Testing Procedure
   Scoring Responses

4. RESULTS AND DISCUSSION 77

Analysis of Variance: 2^5 Factorial Design
Filmic Hypotheses
Population Hypotheses
Reliability and Validity

5. SUMMARY AND CONCLUSIONS 122

Experimental Conclusions
Technical Conclusions
Theoretical Considerations
Future Research Directions

APPENDICES

1. DECISIONS MADE IN EDUCATIONAL FILM PRODUCTION 141

2. TANZANIA: A BRIEF DESCRIPTION 153

3. THE REGIONS AND SCHOOLS: SUMMARY INFORMATION 157

4. SUPER 8MM: PRODUCTION AND PROJECTION 179

5. PHOTOGRAPHS OF TASK TRAINING EXAMPLES AND STIMULUS MATERIALS 200

6. QUESTIONNAIRES AND RESPONSE SCORING PROCEDURES 211

7. STATISTICAL CONSIDERATIONS 223

BIBLIOGRAPHY 235

LIST OF TABLES

Table Page

1. Subject Data 55
2. Descriptive Data for all Scores 77
3. 2^5 Factorial Design Summary Table (ANOVA). 80
4. H_5: Geography Treatment Data (D) 82
5. Summary of Means: B x D x E 82
6. Summary of Means: C x D x E 82
7. 2^4 ANOCOVA Summary Table 87
8. H_1: Chroma Data (A) 86
9. Summary of Means: A x C x E 88
10. H_2: Camera Mode Data (C). 90
11. Summary of Means : B x C 90
12. H_3: Background Data (B) 91
13. H_4: Audio Data (E) 93
14. H_5: Town Experience Data 96
15. H_5: Town Experience - t tests 96
16. H_5: Town Data by School Category 98
17. H_5: Town Data by School Category - t tests 99
18. H_5: Regional Data 101
19. H_5: Regional Data - t tests 101
20. H_6: Sex Data 103
21. H_6: Sex Data for Three Subject Characteristics 104
22. H_7: Age Data 109
23. H_7: Age Data - t tests 109

24. H_7: Age Data - Upper and Lower Groups 110

25. H_7: Age Data - Geography and Education 111

26. H_7: Age and Education - t tests 112

27. H_8: Viewing Experience Data 114

28. H_8: Viewing Data - t tests 114

29. H_8: Viewing Data - Population Characteristics 116

30. School and Class Data 173

31. Data for Pupils Seated in Marginal Viewing Positions . 190

32. Unweighted Means: 2^4 ANOVA 233

33. Least Squares: 2^4 ANOVA 233

LIST OF FIGURES

Figure Page

1. Isometric View of 2^5 Factorial Design 52

2. Layout of 2^5 Factorial Design 52

3. Overall Frequency Distribution. 78

4.- 6. Interaction Plots for B x D x E (BGD x GEO x AUD) 83

7.- 9. Interaction Plots for C x D x E (CAM x GEO x AUD) 84

10.-12. Interaction Plots for A x C x E (CHR x CAM x AUD) 89

13. Interaction Plot for B x C (BGD x CAM) 92

14. Mean Score vs. Age for Males and Females 105

15. Mean Score vs. Age 108

16. Perceptual Hierarchy: Mean Score vs. Filmic Element Combinations 135

17. Map of Tanzania Indicating Regions Visited During Study 158

18.-19. Plate I. Representative Schools (1) 177

20.-21. Plate II. Representative Schools (2) 178

22.-23. Plate III. Animation Procedures (1) 193

24.-25. Plate IV. Animation Procedures (2) 194

26.-27. Plate V. Animation Procedures (3) 195

28.-29. Plate VI. Animation Procedures (4) 196

30.-31. Plate VII. Projection Procedures (1) 197

32.-33. Plate VIII. Projection Procedures (2) 198

34.-35. Plate IX. Projection Procedures (3) 199

36.-38. Plate X. Task Training Examples 201

40.-43. Plate XI. Zoom-In (Beginning) and Zoom-Out (End) 203

44.-47. Plate XII. Close-Up, Zoom-In (End), and Zoom-Out (Beginning) 204

48.-51. Plate XIII. Tilt-Down (Beginning) 205

52.-55. Plate XIV. Tilt-Up (Beginning) 206

56.-59. Plate XV. Medium Shot, Tilt-Down (End), and Tilt-Up (End) 207

60.-62. Plate XVI. Panning Shot 208

64.-67. Plate XVII. Long Shot 209

68.-71. Plate XVIII. High Angle and Short Duration 210

72. Frequency Distribution: Chroma 225

73. Frequency Distribution: Background 226

74. Frequency Distribution: Camera Mode 227

75. Frequency Distribution: Geography 228

76. Frequency Distribution: Audio 229

Chapter 1

Introduction

Under a darkening sky streaked with the final rays of sunset, people begin to take their places as the large outdoor cinema screen comes alive with the "Coming Attractions". Some bring chairs, others blankets, while many use the cement curbing or bare earth as their seating. The peanut vender does a brisk business alongside the cigarette and candy seller's brightly painted pushcart. The last minute paying viewers pass by hurriedly in their cars. Mothers with babies strapped to their backs exchange the day's gossip. Adolescents in school uniforms break off a brief set of soccer tactics as a quite unselected short dredged up from the recesses of Hollywood's past begins to roll. About the time the sky goes black in the west, the feature credits begin and the three hundred or so people sitting, standing or hunkering outside the wall of Dar es Salaam's only Drive-In Cinema turn their attention to the evening's fare. They won't hear the sound; can't fathom all the nuances of story and character; may not have any idea of where the action takes place--or in what era. They are attracted, almost magnetically, as curious, social beings to once again watch the large white screen standing before them in the warm, moist air of an East African evening.

* * *

This study does not go on to report interview findings, observations, and analysis of film viewing behavior in the informal setting of the Drive-In Cinema. That setting is described to illustrate the provocation for conducting film research in Tanzania and to describe what is seen as the end point in a long line of film research investigations. Such investigations would explore the perceptive, cognitive, and affective learning processes of audiences in a systematic attempt to provide an outline for Tanznaian filmmakers on producing effective films for various audiences. But one difficulty is deciding where to begin.

Even the simplest film is composed of many variables--selected from an even greater array by the filmmaker. Once certain key decisions (topic, audience, budget, etc.) are made, other decisions are eliminated and a set of variables takes form. A list of such key variables and decision points is included in Appendix 1. The sheer number of these items indicates the wide scope of film research. Methodology and design for such research are critical for meaningful, interpretable results. A basic research orientation is desirable so that results reflect general principles rather than the highly specific findings of evaluative research. At the same time, the economic realities of film production dictate investigations which suggest practical ways of reducing the costs of filmmaking. Discovering general principles is not, however, incompatible with developing practical guidelines. Hovland, Lumsdaine, & Sheffield (1949) noted:

> But even for practical purposes the decisions one can make on the basis of principles are often more effective--because of their known generalizability--than those based on conclusions from

> specific evaluative studies. The ultimate objective in developing general principles is, in fact, to improve our ability to make wise practical decisions [p. 9].

This study was developed within such a general framework.

The results should interest those whose academic pursuits include Africa, psychology, communication, and education. But hopefully the chief beneficiaries of the results are the present and future filmmakers and film users in Tanzania who struggle to communicate ideas and skills through the use of the cinema.

Tanzania's desire for expanding and improving formal and adult education means greater attention is given to local production of educational media--including films (2.8m/- pact 1970; Danish film experts, 1970). The Government feels that socialist principles require moving towards education for large numbers of people through the use of mass techniques--large numbers of teachers as well as mass media (Nyerere backs adult education, 1970). Television has been temporarily ruled out because of the costs and the practical difficulties of serving a widely dispersed rural population without access to electricity. Introducing television now would conflict with the nation's ideology since only those living in the cities--considered an elite--would benefit. Instead, radio is seen as a better alternative for immeddiate mass communication (Role of radio, 1970).

There is little research information to assist Tanzanian producers in making decisions about the design and use of media. The ambitious introduction of 16mm film production into Tanzania nearly 40 years ago was not accompanied by systematic research. The fact that all of the filmmakers were from different cultures than their target audiences was no impediment to their making generalizations about the audiences' film comprehension (Notcutt & Latham, 1937). Tanzanian filmmakers and film users have now replaced their foreign counterparts and a greater sensitivity to cultural effects of film viewing and production is possible.

Problems arise, however, because educational and sophistication levels can separate the filmmaker from his audience. The topics, treatment and approach can now reflect a truly Tanzanian production but questions still remain which can only be answered by systematic inquiry about how best to design filmic messages for a wide variety of audience backgrounds. One desired effect of the research reported here is to encourage further efforts by Tanzanians to systematically examine film research issues not treated by this investigation and, indeed, to replicate it.

Rationale for Selecting Tanzania

The selection of Tanzania as a site for film research was based on several factors, including the investigator's previous film production experience in Tanzania and hence first hand knowledge of the country (for a brief survey of Tanzania, see Appendix 2). Other equally relevant factors included the country's openness for educational reform (Nyerere, 1967), a single national language (Swahili) which insured uniformity in data collection and analysis, and an emerging interest in local film production. In addition, the absence of a television network and extensive cinema development meant that the research could reflect wide variation in viewing habits. Variation in viewing habits has important theoretical and applied implications which are discussed in Chapter 2. The personal acquaintance of the investigator with Tanzania's more experienced filmmakers meant that the results would be seriously considered and less apt to remain only in the small circle of academics or on a library shelf.

It was also felt that testing a recent technical development, the super 8mm format, would provide information on the feasibility of using this more economical format within classroom and small-to-medium sized group film shows. An evaluation summarizing production of the study's stimulus materials and projection in super 8mm is included in Appendix 4. It was felt that Tanzania's often rugged conditions offer a better equipment testing ground than the comparatively tame Western conditions where the products are developed.

From a broader perspective, a country other than the United States was selected because cross-cultural comparisons increase knowledge of mankind's behavior. Nearly all film research is limited to a thin stratum of the world's population. A great deal is written about the desirability of randomizing within that predominantly white, Western, middle class, educated, male stratum but few argue for randomization within the world's population. In selecting Tanzania as the site for this study, the investigator hopes that cross-cultural comparisons will enrich the present level of film research and theory.

Purpose and Problem

The purpose of the study is to gain insight into the filmic comprehension of Tanzanian adolescent school children and from this knowledge suggest basic guidelines for filmmaking and usage. The problem then becomes: Which basic motion picture variables are most completely comprehended and which population variables influence comprehension?

Definitions

For purposes of this study, the following definitions will apply:

Basic motion picture elements. The minimal or primary technical properties of an ordinary photographically produced motion picture include the following: Chroma, camera mode, visual information level, audio information level, camera manipulation, and lighting. Chroma refers to the use of color or black and white rendition of the subject. Camera mode refers to the use of animation (generally drawings) or live action filming. Visual information level refers to the amount of visual material appearing in a frame. In this study, a dichotomy is formed by using plain backgrounds or ordinary, complex visual backgrounds. Visual information level is termed background for the sake of simplicity and the dichotomous elements are with and without. Audio information level refers to the amount of audio information associated with the projected visual message. A dichotomy is formed by using no audio signal or the sound effect of the activity appearing on the screen. For simplicity, the term used is audio and the dichotomous terms are silent and sound. Camera manipulation is the manner in which the camera is used to portray the subject during filming. This includes the position and movement of the entire camera in addition to manipulation of the lens by zooming and focusing. The following nine camera manipulations are used in this study to generate the shots used as test stimuli: Zoom-in, zoom-out, close-up, tilt-down, tilt-up, medium shot, long shot, pan, and high-angle. Definitions of these and other film production terms can be found in Ely (1963, pp. 117-128). Lighting as a basic motion picture element is deemed a "given" in this study. The possible dichotomy of diffused, shadowless lighting vs. single source, shadowed lighting was considered weak when compared to the previously discussed elements. A further reason for not including lighting as a variable was the already large number of significant basic elements considered important for testing. The basic motion picture elements selected for testing include the four dichotomous pairs: (a) color vs. black and white, (b) animation vs. live action, (c) with vs without background, (d) silent vs. sound; and nine camera manipulations.

Shot. In usual terms this refers to the film resulting from one continuous run of the motion picture camera. In addition to this definition, the shots referred to in this study are defined as being five seconds in duration (there was one exception of 2 1/2 seconds) with various elements experimentally controlled. A shot is the basic unit used to assemble a complete motion picture. In this study, the editing process is all but ignored and the shot, per se, is used as the basis for testing comprehension of basic film variables.

Comprehension. To avoid confusion with the various meanings attached to "perception", this study uses the alternative word "comprehension" to mean the process of physically sensing a message and then identifying the message's content by a written description. This latter condition provides the basis for analyzing responses to filmic test stimuli.

Population variables. The following population variables are included in this study: age, sex, education (Tanzanian standards 6 and 7--equivalent to American grades 6 and 7 in school years but not in age), school location (rural or urban, and Region), previous residence in a town, and film viewing history over the past year. No tribal information was solicited. The Swahili language was used throughout the testing procedure.

Region and town. In Tanzania, the major political subdivision is the region. In United States terminology, these may be thought of as roughly equivalent to a state's division into counties. At the time of the study, there were 17 regions, each having a relatively urban area as the regional center. Town refers to those places which are urban regional administrative centers.

Research in Developing Nations

In developing countries, certain considerations apply which do not necessarily carry the same importance in the industrialized nations. This investigation hopefully reflects the responsibility placed on researchers to make their work relevant to the host nation's goals and needs, widely disseminated, non-repetitious of other research, and conducted so that future research is not jeopardized. Unfortunately it often takes a long time before the results of research prove useful and the necessary subsequent research is conducted. Because the number of Tanzania's filmmakers is limited at this time, the impact of research is potentially great. It is hoped that the results of this study can influence present and future Tanzanian filmmakers to adopt a research-oriented approach to making films.

The stress on relevancy and direct use of the findings in Tanzania should not cloud the fact that the study hopefully increases unequivocal knowledge about human perception processes--particularly in the area of visual and film literacy, and can contribute to theoretical considerations of the cinema.

Taxonomic Specification of Study

This investigation does not examine questions associated with many previous film studies. Because comprehension in this study is related to the perception of images portraying ordinary activities, only the lowest levels of the cognitive domain are required for satisfactory comprehension of the test stimuli. The classification in Bloom (1956) is:

> 1.11 - Knowledge of terminology. Knowledge of the referents specific verbal and nonverbal symbols.--This may include knowledge of the most generally accepted symbol referent, knowledge of the variety of symbols which may be used for a single referent, or knowledge of the referent most appropriate to a given use of symbol [p. 63].

More important is recognition and identification of 3-dimensional activity portrayed in a variety of filmic ways on a 2-dimensional screen. Using Moore's (1970) proposed perception taxonomy this perceptual process is:

> III. Symbol Perception. Behavior that demonstrates awareness of figures in the form of denotative signs when associated meanings are not considered . . .
>
> B. Naming and classification of forms and patterns . . .
>
> 4. Ability to read and comprehend concrete nouns and verbs denoting physical activity . . . [p. 385].

In the affective domain (Krathwohl, Bloom, & Masia, 1964), two behaviors are relevant. One is associated with the specific task of responding to the test stimuli shots:

> 1.2 Willingness to Receive . . . At a minimum level we are here describing the behavior of being willing to tolerate a given stimulus, not to avoid it. Like Awareness, it involves a neutrality or suspended judgment toward the stimulus [p. 107].

The other behavior is associated with the overall research situation:

> 2.2 Willingness to Respond. The key to this level is in the term "willingness," with its implication of capacity for voluntary

> activity. This is not so much a response to outside prompting as it is a voluntary response from choice [pp. 124-125].

Such usual topics of previous film research as learning from a film, testing a completed film, evaluation of films vs. conventional teaching, attitudes towards subject matter presented by film, etc., are excluded from consideration in this investigation. However, the appendices do contain comments on topics considered important to the development of educational filmmaking in Tanzania as well as details pertinent to replication of the study's research.

Chapter 2

Relevant Literature

The cinema is a device designed to achieve a desired end. It is a convenient means for bringing entertainment, information, instruction, or a persuasive message to a large number of people. As such, it is natural that most film research has concentrated on questions related to enhancing learning and changing attitudes, often by comparing a film with live teaching, or otherwise evaluating particular films. Relatively few studies have dealt with the variables which relate to the perception of the content--the sensory variables related to the basic visual and audio components of a motion picture. These elements are often called "production variables"--a term which narrows their conceptual framework considerably and causes them to be taken for granted in most film and television research.

The rationale for taking production variables for granted appears to be an assumption of some uniform level of perception facility among the viewers. The assumption of a high level of "visual literacy" or "filmic literacy" for audiences in media-rich countries has apparently been derived from a hidden hypothesis that increasing exposure to television, film, and print produces increased levels of media comprehension. For example, Schramm, Lyle, and Parker (1961) prefaced their remarks on children's learning from television by declaring: "It is hardly necessary to prove that a child *does* learn from television . . . [p. 75]".

For educators and media producers, the process of *how* the child learns appears to be of much less concern than the outcomes of learning. This investigator's position is that *both* the process and the result are equally important matters for consideration by the designers and users of educational media. As a result of this position, the literature forming the background for this study comes from empirical studies in visual perception, pictorial perception, and film. Reports, impressions, and opinions by filmmakers, missionaries, and anthropologists--"folk research"--were also consulted in lieu of more systematic research on the filmic comprehension of Tanzanians and other African nationalities with relatively low levels of media experience.

The conceptual framework of the study was established by adapting a model of the human perceptual experience developed by Forgus (1966) to fit the basic perceptual elements of the motion picture (chroma, camera mode, background, and audio) used in this study. Forgus has postulated that the visual perceptual experience can be broken down into subtasks which "can [then] be ordered into an hierarchy from the simplest to the most complex task, in which *each successive progression up the hierarchy involves the extraction of progressively more information from the stimulus energy* [p. 15]." He then identifies five ordered tasks:

1. The *detection* of the stimulus *energy* (light) and a discrimination of the change in stimulus energy.
2. The *discrimination* of a *unified brightness* or *figural unity* as separate from the background.
3. The *resolution* of finer details, which gives rise to a more *differentiated figure*.

4. The identification or recognition of a form or a pattern.
5. The manipulation of the identified form; this happens, for example, in problem solving and social perception [pp. 15-16].

In clarifying this set of perceptual tasks, Forgus explains:

> Emphasizing the fact that when we talk about energy, we are referring to its informational aspects, it is not hard to see how the progression from task 1 to task 5 involves the extraction of progressively more information. Concurrently, it is to be expected that the brain as an active, selective agent also becomes increasingly involved as we ascend the hierarchy [p. 16].

One strategic reason for selecting the Forgus hierarchy was that it is similar to Gagné's (1965) eight types of learning which range from signal learning to problem solving. The task confronting the subject in this study remained constant with respect to Gagné's hierarchy: verbal association (type 4) or linking an action with the proper verbal symbols. Learning of simple but basic concepts must have taken place in the subject's past in order to identify the actions and objects comprising the stimulus materials.

The linkage between the two hierarchies is admittedly loose as employed in this study. For more complex film research to follow, it is clearly desirable to select conceptual frameworks which allow systematic progression from the elementary perceptual tasks to the more complex problem solving issues. The hierarchical approach of Forgus and Gagné allows comparison of dichotomous combinations of elements which are typical of film design and production decision making.

The main problem of the study is: Which basic motion picture elements are most completely comprehended by Tanzanian adolescent viewers? Using Forgus' terminology, the problem can be restated as follows: Which combination of motion picture elements provides least ambiguous identification or recognition of a known form or pattern (task 4)?

The perceptual model suggests a hierarchy for each of the visual elements defined as basic motion picture elements earlier. The scaling dimensions are continuous from simple to complex, abstract to realistic. The elements in the study are treated as dichotomous. For example, the camera mode element has an infinite number of subtle degrees between a schematic drawing and a realistic photograph. For purposes of comparison, an arbitrary point was selected as "animation drawing" and tested against realistic live photographic reproduction. It is clearly desirable for later research to develop a more continuous set of stimulus materials so that greater accuracy can be obtained in fitting camera mode to a given audience and relating this to the perceptual model.

Clearly this interpretation of Forgus' perceptual model for basic film elements is subject to scrutiny--and testing. Can different combinations of basic film elements be brought together in the form of a hierarchy of comprehension? What characteristics of the audience determine the hierarchy, or is there a fixed hierarchy of perceptual tasks which is built into human beings regardless of past experience and diverse perceptual learning opportunities? These questions give additional guidance in reviewing the literature relevant to this study.[1]

---

[1] This summary includes material available to the investigator through December, 1969.

Chroma: Color vs. Black and White

Considering the significance of the issue, both theoretically and practically, there are relatively few studies which examine the question of color vs. black and white motion pictures. VanderMeer (1952) used adolescent pupils in an American high school to test learning and attitude toward five films screened in black and white and color among various groups in two experiments conducted in the late 1940's. The results from three out of five verbal delayed posttests indicated significantly greater retention by the color group. However, none of the five nonverbal posttests showed significant differences, and the conclusion was that there was no significant difference between black and white and color. While the color films were preferred over the black and white, there was not a relationship between learning from the color films and liking them.

May and Lumsdaine (1958) report neither increased interest nor learning gains for color in a study conducted in the early 1950's using fifth and ninth grade American pupils tested before and after viewing a single film on osmosis.

Kanner and Rosenstein (1960) tested color television against black and white for increased learning of electronics and photography by American army trainees in the late 1950's. Even in teaching the color coding for resistors, no difference could be found between the two versions. Despite some tendency for the low-ability trainees to learn more from color and the high ability ones to learn more from black and white, the investigators were forced to conclude that color television was not justified.

Rosenstein and Kanner (1961) used American army personnel again in testing color television against black and white for teaching missile system repair. The similarity of results for the two treatments extended to both high and low ability groups in this followup study.

Utz (1969) tested university freshmen for their rating of reality of ten silent color vs. black and white film clips. He used three groups (color, black and white, mixed) in his treatment and concluded that their rated perceptions of reality (defined as a real vs. a staged event) were not affected by chroma. Color was rated as faster, more interesting, and more serious than the black and white in a semantic differential questionnaire.

Kanner (1968) examined various reports related to the instructional use of color television and concluded that color offered no learning advantage over black and white.

The American evidence strongly indicates that learning by films (or television) is not dependent upon chroma. Most of these studies suffer from the limitation of using a simultaneous verbal message so that the learning was not based solely on visual learning but also had a high verbal component. The now classic VanderMeer study used a nonverbal test as part of the measurement and employed more than one film, but all of the films had sound tracks and it is unclear how much information was conveyed by the narration which would reinforce the visual component of the films.

American film research on this topic is limited indeed and European film research is virtually unknown in the United States. A search in two large annotated bibliographies (Coppen, 1968; UNESCO, 1961) from England and Europe, respectively, contained no useful information on the chroma topic. From Africa, most evidence is in the form of anecdotal reports based on observation by foreigners. Doob (1961) is a major source. It has been one of the primary concerns of filmmakers in Africa, however, and various writers have displayed some emotion about the value of color over black and white. The debate is important since the costs of producing color films are much greater for African nations than for the industrialized nations. If, however, there was clear evidence that color was superior to black and white films, the cost factor would be of less concern than the need to communicate ideas and information effectively.

The director of Great Britain's Colonial Film Unit, George Pearson (1948), set the pattern of thought for his colleagues by declaring:

> With regard to coloured films, there can be no question but coloured films help tremendously in getting a story across to Colonial peoples. One of the drawbacks has been the printing of copies for coloured films. In certain territories they are now using colour. In the Gold Coast [Ghana] they are making their films almost 100 per cent in colour. We know from the reactions of the audiences there that these films are greatly appreciated [p. 43].

Sparked partly by the various research programs going on in the United States, the Colonial Film Unit decided to conduct some of its own research. P. Morton-Williams, an anthropologist specializing in the Yoruba people of Nigeria, conducted a study in 1951-52 involving the local production of films, content analysis of written essays of school children, and field assistants sitting in the audience as participant observers. A variety of Nigerian tribes were tested on several filmic issues. Morton-Williams (1953) concluded:

> Colour seemed to be of very little importance; many people failed to notice that some films were in colour. It did not in itself increase interest or enjoyment; any use it may have probably lies in serving with tonal contrast, with light and shade, and with depth of focus, to distinguish objects from each other . . . [p. 45].

Another member of the Colonial Film Unit working in Tanzania in the early 1950's hypothesized the same thing from his observations (Spurr, 1952). He felt the important element for comprehension was "the movement provided by the motion picture itself [p. 44]."

Powdermaker (1962) conducted anthropological studies in the Copperbelt region of Zambia in the mid-1950's. She included film attendance habits and audience observation in her work. While not testing comprehension, she did observe:

> The cowboy and other American films were usually fairly old and in black and white. Some of the films made in Africa were in color. The original survey had no question on preference for black and white and color films, but later interviews showed 100 per cent preference for black and white films. The main objections to the color films were that the colors were not "natural looking" and that Africans looked too black in them. The attempt to make the films seem more real with colors evidently made them seem more unreal [p. 260].[2]

Hudson (1959) tested 147 Africans working in South African mines with black and white and color versions of a film giving instructions for a manual aptitude testing procedure. He concluded that understanding test instructions as measured by performance was not improved by using color.

Alan Holmes (1964), an influential British health educator working in Kenya, concluded:

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[2] Local production units at that time used almost entirely Kodachrome original and Kodachrome duplicating stock which resulted in high contrast and drastic shifts in color balance.

> The choice between black and white and colour, and the particular colour used, can influence the impact of visual media. Little investigation of this subject has as yet been practicable in Africa, but enough is known to make it fairly certain that colour does actually help people in their understanding of visual forms. From tests carried out it appears that pictures made in artificial colour, for example cartoon films, are more easily understood than those in black and white, and that films and photographs in natural colour are better still [p. 68].

These comments are without elaboration or citation. Serpell (1968), using geometric forms, later found that color was in fact an attentional preference over form for remote unschooled villagers in Zambia but not for rural or urban educated Zambians.

The available evidence from Africa clearly indicates that the addition of color does not increase learning from a film. The assumption made throughout the reports is that color is not a vital cue to determining what is learned and consequently what is tested or observed. While these reports lack the rigor usually expected of experimental studies, the only disagreements come from a filmmaker stating an opinion at a time when 16mm color films were at the beginning of their development and the remarks of an experienced health worker using uncited evidence.

Working in Uganda, Evans and Segall (1969) found that schooling and degree of urbanization affected results of an experiment which tested whether subjects were more likely to sort drawn pictures of objects by color or by function. The use of color as the sorting cue was learned more readily by younger, less educated, more rural school children as well as unschooled children from either a rural or urban setting. Function was learned more readily by the older (but not overage for grade) school children from an urban environment.

While a sorting task differs from the filmic comprehension task of this study, the interesting findings from the Uganda sample are the differences with the various backgrounds of the subjects and the obvious attention of the subjects to the physical attributes of the pictures rather than their functional relationships. Going further, Evans and Segall (1969) eliminated color and substituted shading so that strictly black and white drawings (shaded vs. line drawings) were sorted by a second sample of urban grade three primary school children. It was reported that the pupils maintained the same level of sorting by function but found sorting by shaded vs. line drawings a very difficult task. One conclusion which might be derived from the Evans and Segall (1969) findings is that the use of color in motion pictures in Africa may have a different quality or cueing function than experienced in the industrialized nations where schooling has reached high proportions of the population. The basic perceptual nature of this study and the use of a schooled population may mean that it is not sensitive to more complex perceptual tasks normally found in complete films for which color might be important.

Camera Mode: Animation vs. Live Action

Unlike the universal distinction between color and black and white films (more accurately, polychromatic and achromatic), the distinction between animation and live action films is one of degree as well as production technique. Animated figures can be highly exaggerated, matchstick figures drawn directly on the film, highly realistic drawings, photographs, realistic 3-dimensional puppets, or even real figures who are filmed with the typical animation approach of building a motion picture by filming one shot at a time. These various techniques form a rich spectrum of abstract to realistic representation of a given subject. Lumsdaine (1963) notes the lack of experimental study of animation techniques and indicates the necessity for identifying "the precise function of the devices experimentally studied [p. 632]."

Live action cinematography intends generally to reproduce the human subject as faithfully as possible and to maintain the perspectives normal to the viewer. Since the principle consumers of the results of this study are Tanzanian filmmakers and film users concerned with educational and informational uses of films, the animation discussed here reflects simplified but realistically drawn figures (See Appendix No.5) which closely resemble in costume, action, and perspective a natural setting. This is also the context for the live action. The search through the available literature reflects this approach and thus cartoons using animal figures, etc., are excluded from extensive consideration. The purpose of comparing the two modes for comprehension is to discover if simplified but unexaggerated figures which are characteristic of figure animation are more readily recognized and identified than live action figures which contain a larger amount of visual information.

Hoban and van Ormer (1950) could not find a direct comparison of animation and live action in their summary of American film studies between 1918 and 1950 (pp. 8-17). Reid and MacLennan (1967) in their summary of 1951-1953 American studies reported two studies (nos. 188 & 310) which compared labelling and graphic type animation and live action, but neither of these were direct comparisons of figure animation.

A study reported by May and Lumsdaine (1958, Chapter 2) experimentally compared a rough pencil drawn version of a film on the seasons with a completed color version for primary school science pupils. A posttest after both films revealed no significant difference between the two versions although the authors emphasize the lack of control of content between the two versions and caution against generalization.

No comparisons between animation and live action cinematography were found in any European or African references. Various opinions have been given about the showing of cartoons in Africa, particularly of the Disney health cartoons (Holmes, 1964; Ladkin, 1951; Pickering, 1954; Powdermaker, 1962). The consensus appears to be that there is understanding of the visuals but the total story is often misinterpreted (Powdermaker, 1962, p. 266).

Some studies in Africa have directly compared drawings with still photographs; others have explored comprehension of other pictorial stimulus materials. Examination of these studies or surveys may provide insights into the animation vs. live action film issue. Many of them support the logical analysis of Segall, Campbell, and Herskovits (1966) who argue that the ordinary black and white photograph contains contours and stimulus characteristics too subtle for the person inexperienced with photographic conventions. Their analysis

> . . . implies that cut-out photographs of persons, done so that paper contour and person coincide, would be more easily perceived; and line drawings might be expected to be better perceived than ordinary photographs because of the relevancy of the dominant contours [p. 34].

Holmes (1963) and Shaw (1969) examined the comprehension of a variety of pictorial symbols and drawings in Kenya. Both have methodological deficiencies but provide data on samples similar to this study's primary school adolescents. A wide variety of pen and ink drawings were tested for recognition and revealed that familiar objects, particualrly various protrayals of humans, are recognizable from schematic to detailed portrayal.

It appears that detailed drawings with backgrounds and minimal feature outline drawings suffer some loss of recognition but the portrayal of figures with "minimum realistic detail" such as shading is optimal. This is confirmed by a study of the same nature conducted in Malawi (Bean, n.d.). Portrayal of a woman pounding maize was presented to an adult illiterate sample (n = 79) in five ways: highly schematic (matchstick), minimum pen and ink outline, minimum realistic detail pen and ink, silhouette, and black and white photograph. Only the photograph had a background, thus breaking the possible valid comparison between the photograph and the drawings. The comprehension results favored the minimum realistic detail drawing but the preference was for the photograph.

Fuglesang (1969) conducted a similar study more systematically in Zambia with illiterate adults (n = 63) using four variations of seven different situations, three with human figures and four with various objects (minimum feature pen and ink drawing, silhouette, photograph without background, photograph with background). The photograph with the background blocked out produced the most readily comprehensible image. The pen and ink minimal feature drawing mode was indicated as least readily comprehensible.

Doob (1961) conducted limited pilot studies in Northern Nigeria on comprehension of photographs and drawings. The subject matter in the two sets of stimulus materials was not the same and direct comparison of the results was not possible. The general results, however, indicated little difficulty in identifying the substance of both the photographs and the drawings for the educated and illiterate male groups sampled (n = 20). Collier (1967) has noted that the subject matter is very important in determining responses to photographs and that Peruvian Andes Indians previously considered pictorial illiterates were able to identify their friends from viewing photographic negatives (pp. 56-57).

Because of the lack of studies dealing with the filmic aspects of the drawing vs. photographic question, the exact nature of motion as a decisive stimulus in aiding comprehension for the person inexperienced in pictorial display is unknown. Segall et al. (1966) observe that "the experience of anthropologists shows that motion pictures are almost universally perceived without trouble . . . [p. 33]."

It should be remembered that this study's population was composed of school children while many of the above data refer to unschooled adults. School children presumably have had experience in looking at pictures, posters, and illustrations which add some sophistication to their pictorial perception facility and, by implication, filmic comprehension. This matter is discussed again later in the chapter under viewer characteristics: rural vs. urban and age level.

Visual Context: Plain vs. Complex Background

It is revealing to note that the presence or absence of background had an effect on several of the studies cited in the section above. Two important factors in determining effective comprehension for the groups studied appear to be amount of detail within the figure and similarly within the background. The perceptual phenomenon is generally called the "figure-ground" experience and has received considerable attention by gestalt and other psychologists.

Film researchers have apparently not considered this an important issue. This study was underway when Travers (1970) observed:

> One can reasonably assume that very complex visual displays, such as are provided by most films, encourage the viewer to scan a large amount of the information presented, but at a very crude level of analysis . . . .The easiest way of ensuring that a particular object will become the figure and that the rest will merge into the background is to eliminate features of the background and present the part to be designated as figure on a uniform gray field. This is not often done by film producers, who like to provide an appropriate natural setting for the object that is the focus of interest. The effect of such a complex background on the understanding of the object that is the center of interest needs to be investigated [p. 66].

Only one study was found in the American and European literature of film research which touched on the issue. Ellery (1959) compared a "limbo" set (plain background) vs. a "nonlimbo" set (complex background) in a study of production variables using kinescopes of five speeches on various public speaking topics. Using pre-, post-, and delayed posttests, he found no significant difference between the two. Since the subject matter was heavily verbal in nature, this is not an unexpected result.

The previous section (camera mode) contains studies dealing with pictorial perception in Eastern Africa. The results of those studies all favored a plain background over a "realistic" background for maximum comprehension. A question unresolved is whether the motion of a central subject compensates for the addition of visual information in the complex background and minimizes the difference with a plain background. None of the filmic variables discussed here more clearly reflect the use of the Forgus perceptual hierarchy than the figure-against-ground or visual context issue.

Audio: Silent vs. Sound

Chroma, camera mode, and visual context are three components in the design of the visual channel of the motion picture. Working alone, the visual channel can carry even sophisticated ideas if properly designed--as the silent movie era amply proved. For filmically unsophisticated audiences, the audio channel might enhance recognition of visual elements by providing an additional cue to recognition of the visual message. This suggests the use of appropriate natural sound effects and/or relevant verbal information with the visual presentation--the typical sound motion picture. In this study, a verbal message is excluded from consideration since the thrust is on the iconic rather than symbolic form of the motion picture. Any verbally expressed cues would short-circuit verbal-based measurement of comprehension of the realistic, visual, and non-verbal audio elements of the motion picture. Defining the function of verbal cues and information in the motion picture is thus outside the limits of this study.

Since nearly all film research has been evaluation-oriented, experimental examination of sound effects as an additional cue for recognition in motion pictures has apparently not been undertaken. All the film research reports available to the investigator dealt with verbal or music sound tracks and did not include natural sound effects as a controlled variable in the comprehension of the motion picture.

This is puzzling since the introduction of sound films sparked a great deal of interest for film theoreticians (Arnheim, 1957; Spottiswoode, 1935). The reasons for this lack of research are clear enough: If any audio information is necessary to strengthen the visual component, the obvious solution is to verbalize the information.

The use of music to provide a mood also dates back to the silent movie era when pianists and organists used different musical conventions to correspond with the film's action. Some theatre organs were equipped with a limited array of sound effects--whistles, sirens, car horns, etc.

Interest in realistic, non-verbal sounds is apparently missing among perception psychologists as well. Gibson (1956) observes:

> For man, there are classes, subclasses, and instances of identifiable sounds in countless variety . . . .In general they have not yet been studied under controlled laboratory conditions, with the exception of the fundamental speech sounds . . . [p. 89].

Experimentation using audio and visual stimuli to test human information processing techniques and determine the relationship between the two sensory modes in human learning has become intensified during the past decade (Hsia, 1969; Travers, 1967). This investigator contends that for purposes of this study, the experimentation dealing with short-term memory and relying exclusively on verbal stimuli for both audio and static visual modes is of minimal value in predicting the results of a cinematic visual vs. audiovisual comparison when the stimulus materials are iconic, realistic portrayals of familiar activity.

Viewer Characteristics: General Discussion

It is not enough to report only results of testing film variables when the population sampled is heterogeneous on a variety of organismic factors. These factors may be related to filmic comprehension as suggested by Hoban and van Ormer's (1950) "principle of audience variability", Snow's (1963) multi-variate analysis of a large number of audience characteristics and Salomon and Snow's (1968) summary of studies suggesting that consideration of individual characteristics can alter the conclusions of media studies. The reasons for many studies omitting audience characteristics in the interpretation of results or the experimental design itself may stem from a lack of concern for theoretical bases for research.

The theoretical concerns of this study arise from film as a perception phenomenon and as such reflect the outlook of perception psychology. In developing a hierarchy of perceptual tasks, Forgus (1966) examined evidence from a variety of studies supporting his model. Included in this evidence was a variety of organismic factors. A central issue is prior experience as a factor in identifying form. Many investigators feel that experience shapes a person's perceptual development and is often related to his/her age. Education can determine certain kinds of experience and is also related to age. In much of Africa, for cultural reasons, an individual's sex determines access to education, which often affects linguistic facility. Linguistic facility affects testing and evaluation which determines socio-economic and geographic mobility. Diversity of environment can determine responses to optical illusions--in other words, perceptual tasks.

The factors noted above are only a partial listing of those that Snow (1963) has isolated as researched or possible characteristics affecting learning from films. His list included nine viewer variables which have received empirical support and nine others hypothesized as related to learning from films but without empirical support to that date. Eight of these were affective factors ("attitude toward the subject matter presented via instructional films") and were directed exclusively towards the film learning situation rather than as general organismic variables. Since attitudinal variables have been defined as outside the limits of this study, some of the remaining audience variables suggested by Snow (1963) are of interest. These include: age, sex, educational level, intelligence, previous knowledge of subject matter, past experience with instructional and entertainment films, socio-economic status, and familiarity with cinematic techniques (pp. 7-9).

This study has chosen to limit the content action of the stimulus materials to ordinary, well known human activities. This decision avoids confounding identification of images with testing unfamiliar subject matter. Only a single educational level (Standard 7) has been selected to insure adequate linguistic ability in testing and to describe a population which is the target of extension and vocational training efforts in Tanzania. Intelligence must be ruled out for lack of adequate tests (Vernon, 1969). Socio-economic status usually connotes the degree of access to an enriched educational and cultural (aesthetics) setting. The very few people in Tanzania who would be considered "middle or upper class", as well as the national philosophy, rules out any planned comparison on a socio-economic basis when personal interviews are not included. A substitute for this is geographic environment, dichotomized as rural vs. urban. This factor has important theoretical implications (Greenfield, 1966; Segall et al., 1966).

The viewer characteristics which are theoretically interesting, experimentally possible, and functionally salient for filmmakers in Tanzania are age, sex, prior film experience, and geographic environment. It is reasonable to take these into consideration when planning a film. Most instructional films are directed at specific audiences and these four variables plus the given educational level should account for most of the variance in comprehension attributable to individual differences. The four audience variables selected for scrutiny in this study are examined more closely in the next sections. References, where possible, are limited to the African context.

Viewer Characteristics: Rural vs. Urban

Children raised in rural Tanzania have a decidedly different visual and aural environment than their urban colleagues. The number of man-made perceptual stimuli is obviously greater in the urban setting. Access to pictorial material is greater. The world is made up of more rectangular and squared surfaces--a "carpentered world" as Segall et al. (1966) label this kind of environment. There is greater access to film shows--both outdoors for free and in the commercial cinemas. In addition, manmade sounds are important. The sounds of radios, phonographs, cars, bicycles, and objects particular to the urban setting convey pleasure, danger, and many forms of information. The visual setting is often similar from town to town so that the urban inhabitants have a more uniform visual environment than rural dwellers from diverse rural areas.

In the rural setting, the amount of visual and aural information is not necessarily less but is of a different nature. Visual forms are not as squared. There is greater diversity of the visual setting--forest, rolling savannah, mountain vistas, flat seacoast. Similarly, the sounds--the tides, wind, birds--are more likely to be those of nature than of man.

The differences in the perceptual environment between urban and rural inhabitants are reduced somewhat for those attending schools in rural areas. The rural-urban dichotomy of this study is thus not the dichotomy of the unschooled rural person who has never left his or her home and the lifelong city dweller who knows only blocks of apartments en route to the multi-story school building. Nevertheless, it is important to know if films for rural audiences should receive different production techniques than those for urban audiences. It is expensive to make several versions of one film but it is also a waste to make a single film which is useful for only part of the intended audience.

The literature which might be expected to compare filmic comprehension between urban and rural viewers does not do so. Powdermaker (1962) observed both urban and rural audiences but makes no distincion. Doob (1961) surveyed many sources but did not mention an urban-rural difference in his analysis of filmic comprehension. The earliest films produced in Tanzania by Notcutt and Latham (1937) were summarized along with detailed audience behavior during the showings but no distinction was made between urban and rural audiences. Forsdale and Forsdale (1966) discussed levels of film literacy but did not relate these to any geographic environment. Their cited evidence of rural illiterates not having sufficient perceptual training or experience for any meaningful filmic comprehension is contradicted by Spurr's (1954) observations.

There are studies of pictorial perception (e.g. Hudson, 1960) and susceptability to optical illusions (e.g. Segall et al., 1966) which do compare urban and rural samples. It is unclear whether there is a direct and meaningful correspondence between filmic comprehension, pictorial perception, and susceptibility to optical illusions.

Systematically conducted studies of the latter two provide some additional information from which to make a guess as to the effects of visual environment on filmic comprehension.

Hudson's (1960) now classic study of 3-dimensional pictorial depth perception among South African blacks and whites, together with replications elsewhere in Africa (Deregowski, 1968; Holmes, 1963; Mundy-Castle, 1966), indicates the complexity of analyzing viewer characteristics and responses to pictorial stimulus materials and arriving at explanations which give solid guidance to artists, educators, and publishers (Hudson, 1967). Using a series of 11 unshaded, minimal detail pen and ink outline drawings which employed the depth cues of size, linear perspective, and continuity of outline, Hudson (1960) found that ongoing education, urban environment, and contact with an enriched pictorial environment contributed to perceiving 3-dimensional representation in the drawings.

Obscured in his results are the findings using a single much smaller (6 x 4 inches vs. 20 x 15 inches) black and white continuous tone photograph which represented one of the drawings by using object models with the addition of texture and shading. Far fewer subjects saw the drawings as representing 3-dimensions as compared to the photograph. Only a group of illiterate miners of rural origin did not see the photograph as representing 3-dimensions. The other groups ranged from 72 to 100%. Doob (1961) found similar results in northern Nigeria using different stimulus materials.

Gibson (1950) has stated that the fundamental properties of the visual world seem to be that:

> . . . it is extended in distance and modelled in depth; it is upright, stable, and without boundaries; it is colored, shadowed,

> illuminated, and textured; it is composed of edges, shapes, and interspaces; finally, and most important of all, it is filled with things which have meaning [p. 3].

Hudson's (1960) test of pictorial depth perception appears to test knowledge of European pictorial symbols and conventions rather than being an instrument to gain knowledge about how non-Europeans of varying educational and ecological backgrounds process pictorial information. Nonetheless, his findings do indicate the power of education and urban dwelling over other characteristics in dealing with pictorial stimulus materials.

Deregowski (1968) has studied pictorial depth perception extensively in Zambia using Hudson's test and others designed to discover the process of depth perception among various cultural, educational, geographic, and age groups. His efforts have indicated some of the limitations of Hudson's approach in terms of the types of stimulus materials and the mode of responding. While partially confirming the limitations of perceiving 3-dimensions in flat drawings by rural and urban African school children, his results point towards the need for more sophistication in exploring the topic. Dawson (1967), for instance, has shown that formal training with pictorial materials can significantly increase the 3-dimensional response of Sierra Leone males with secondary education. His findings support the hypothesis that experience does affect pictorial perception.

Greenfield (1966) and Greenfield, Reich, and Olver (1966) investigated various questions of cognitive growth from a Piagetian perspective in Senegal. They used tests of conservation of quantity and equivalence grouping using objects and drawings. Greenfield, Reich, and Olver (1966) concluded that the difference between the schooled and the unschooled was greater than the rural-urban difference and noted:

> But though the rural-urban difference is small, it is similar in nature to a larger difference that separates children who have been to school and those who have not. The difference in both cases is most completely described as a difference between abstractness and concreteness. We believe that the difference between the city child and the rural child derives from a differential exposure to problem solving and communication in situations that are not supported by context--as is the case with, for example, most reading and writing, the use of monetary exchange, and schooling. Rural life, it appears, is somewhat less conducive to the development of abstraction [p. 315].

Segall et al. (1966) adopted a different approach and explored the effects of visual environment using susceptibility to abstract (and presumably culture-fair) optical illusions among samples from 15 different cultural groups ranging from rural East Africa to urban America. They hypothesized that people living in a carpentered world and having abundant exposure to pictorial materials would be more susceptible to the Sander parallelogram and the Muller-Lyer illusion than people living in rural settings. An "Inventory of the Visual Environment" was taken by the various test administrators to provide data on the degree of horizontal and vertical environmental features as well as other relevant visual factors in the subjects' surroundings. A horizontal-vertical illusion was used to test for susceptibility to the illusion as a function of visual horizontal or vertical predominance in the subjects' lives. They concluded that life in a carpentered world and experience with pictorial materials did lead to greater susceptibility to seeing lines arranged in optical illusions as representing 3-dimensions whereas people living in rural, non-rectangural visual environments tended to see the illusions as what they were, 2-dimensional. People living in a horizontal visual environment were more susceptible to the horizontal-vertical illusion than those living in more vertically dominant environments. A rural-urban perceptual difference was thus determined.

Jahoda (1966) conducted similar optical illusion experiments within rural Ghana which did not agree with the Segall et al. (1966) results. Susceptibility to the Muller-Lyer illusion did not resolve into a rural-urban dichotomy. One of Jahoda's preliminary explanations was that schooling may have an effect similar to the impact of a carpentered world environment. Deregowski's (1967) analysis indicated further exploration is necessary to produce more firm explanations of the illusion-ecological phenomenon.

In summary, direct systematic comparisons of filmic comprehension between rural and urban groups do not appear in reports and studies available to the investigator. Systematically conducted non-filmic studies are reported in the literature and indicate a rural-urban difference, but this appears to be confounded with education. By holding the amount of formal education constant, it would be possible to more adequately test the rural-urban dichotomy. Since the urban world presents more 2-dimensional images to its inhabitants than the rural environment, the inclination is to accept the Segall et al. (1966) conclusions and predict higher filmic comprehension among urban dwellers than rural residents. However, anecdotal evidence indicates that even audiences extremely unsophisticated filmically recognize familiar images after a brief period of puzzlement when portrayed as motion pictures, but may not discern the logic resulting from linking of shot to shot (Griffith, 1953; Huxley, 1931; Spurr, 1954). Because of the importance of the rural-urban dichotomy--and lack of clear evidence--it was appropriate for this study to incorporate the issue into the design in order to examine possible interactions between filmic elements and this audience variable. Since education appears to be a powerful factor in pictorial perception, the prediction was that the rural-urban results would not be different.

Viewer Characteristics: Male vs. Female

Access to formal education and the world beyond the traditional setting is more limited for females than for males in Tanzania. From the investigator's observations, fewer women attend outdoor film shows and commercial cinemas than men. No direct data was available to predict whether these factors influence filmic comprehension. Films especially for women's education and information have been made for some time (Notcutt & Latham, 1937). It is desirable to discover if any differences do exist in the way women comprehend basic filmic elements.

Hoban and van Ormer (1950) noted the following after summarizing American film research during the formative years of the motion picture:

> In some cases, persons of different sex have been found to repond differently to films. Most likely, sex differences in responses to films are largely the result of the values, activities, occupations, and other social norms assigned in the American culture to males and females. Whatever their origin, sex differences may affect the attitudes and information gained from films, and they do affect attendance of teenagers, at least, at entertainment motion pictures [p. 9-5].

In their summary of research studies conducted after the Hoban and van Ormer survey of the literature, Reid and MacLennan (1967) reported four studies indicating no difference, one favoring males, and one favoring females in a variety of film and television. Maccoby, Wilson, and Burton (1958) report significantly different fixation patterns for males than for females in a study of eyemovement responses to feature films.

Studies from France reported by Mialaret (1966) indicated that the greatest differences in various physical behavioral responses to a Chaplin film were between male and female viewers in the primary school years (ages 6-11) and that the differences narrowed as the ages reached adolescence. There was no discussion of filmic comprehension as related to sex difference--the inference being that image comprehension was the same but affective response to the film was different.

In the research and remarks about the cinema in Africa surveyed for this investigation, no specific references were found about differences in viewing by men and women when such factors as education were held constant.

Vernon (1969) noted that test performance may vary with sex:

> Traditionally again the men are the talkers, who settle the affairs of the community. These differences in sex-roles and attitudes, compared with those of the Western nations, have interesting effects on test performance. Both in Zambia and Rhodesia it has been shown that boys perform appreciably better on vocabulary and attainment tests which depend heavily on language, whereas there is little difference from girls on non-verbal tests . . . [p. 180].

Mbilinyi (1969) did not compare boys vs. girls in her study of attitudes toward education by Standard 4 girls and their fathers but did discover socio-economic, rural-urban, and achievement motivational differences between girls attending schools and nonschool girls. The greater enrollment of boys than girls in formal education in Tanzania suggests that the girls who do attend schools may be more serious about gaining an education. They generally come from families with one or both parents having some education and higher socioeconomic status, as rated by Mbilinyi.

No prediction can be made about results of this study based on a viewer's sex after considering the available literature--especially since many studies do not report breakdown of results by sex. From Mbilinyi's (1969) findings, a possible interaction of geographic location (rural-urban) with female scores was suggested.

Viewer Characteristics: Age Level

Age and education generally progress hand-in-hand in the industrialized world. The term "lockstep" is used in the United States to disparagingly suggest the rigidity of the age-education process there. Under such circumstances, it is difficult to isolate the age factor from the education contribution to responses on a perceptual development measurement. In this study, age of the viewer was seen as a key variable since educational films are often made for a specific educational level (especially if linked to a curriculum). On the more theoretical level, adolescence involves changes in the cognitive growth of individuals and this growth is more easily mapped if education is maintained at a certain level.

In Tanzania, it is possible to find a wide range of adolescent ages in the later primary school levels. Vernon (1969) points out that this wide range may be from late entry into the schools because the school is too far to attend for younger children, missing a year or more because of need at home or lack of school fees, and repetition of a year or more in order to retake the primary leaving examination. Since this information could be embarrassing to respondents and was not essential to the overall goals of the study, the investigator decided not to attempt an accounting of the reasons for a wide age range.

American and European film studies indicate strong correlations of response patterns with varying age levels. These generally follow the natural maturation pattern and there was little expectation that this would differ for African school children. Hoban and van Ormer's (1950) comments summarize the early American research findings:

> Intelligence and formal education increase with age up to a given point, but age itself is a variable in the way people react to films. As a variable, age is important to the extent that breadth of experience, interests, resistance to excitability, and the leveling and declining of mental alertness vary in different ways with age in an otherwise homogeneous group. The ability to perceive and to retain motion picture content seems to reach its peak somewhere in the late teens or early adulthood, and then gradually declines [pp. 9-4 - 9-5].

However, most American film research has not examined the age variable as seriously and in the same depth as the French research with primary age pupils.

Mialaret (1966) provides reports of his and other findings which indicate age differences on various dimensions of film viewing through the primary grades. Using three filmstrips without narration he elicited responses from 21 school children from 7 to 11 years old; placing the responses from a complete showing and a frame-by-frame showing into Binet's categories of enumeration, description, and interpretation. The results indicated variation of effects with the stimulus materials and age trends. There was a clear shift from simple enumeration of objects to greater interpretation of the story as pupils became older but the amount of shift was related to the particular filmstrip (pp. 159-169).

Mialaret (1966) reported the conclusions of two separate researchers, G. Heuyer and R. Zazzo, who had done extensive research in France on cinematic comprehension and intellectual development:

> Below the seven-year mental level the child sees images, understands short sequences, but cannot follow them in logical order; below the 9-10 level he can follow the sequences, but does not grasp their significance . . . .A single sequence of four shots is understood at the age of seven, but the child cannot follow the 20 or 30 shots which form a full-scale film. Zazzo goes on to say it is probable that, even when he becomes deeply involved in the film, the child does not follow the line of the story it tells. It is only from 9 to 10 onward that he can follow the order of shots. Between a mental age of 10 and 12 he can follow the continuity in the sequences, but cannot grasp its significance. It is from a mental age of 12 that, in general, he can understand the film as a whole and becomes capable of grasping its central idea [p. 172].

An important factor unspecified by these writers is the element of prior film viewing experience--a factor which may or may not influence comprehension and which is confounded with age.

The paucity of film research from Africa once again forces examination of other kinds of studies possibly related to filmic comprehension and age level. In the second part of Shaw's (1969, pp. 39-53) survey of pictorial symbols in Kenya, clear age trends were found for identification of objects in 17 black and white drawings with moderate detail showing various typical urban and rural scenes in East Africa. The survey sampled both schooled and unschooled children ranging from ages 5 to 15, mostly from urban areas (n = 1352). For both the schooled and unschooled groups, trends existed which indicated that maturation almost always meant more accurate naming of the objects in the pictures (no significance levels given).

A finding not analyzed or discussed by Shaw (1969) was the apparent lack of difference between the schooled and unschooled in identifying unambiguously drawn common objects but clear superiority by the schooled in identifying details and objects which might be ambiguously drawn. Again, maturation had the same effect as schooling in increasing recognition.

After testing the effects of age, schooling, and geographic location on the Piagetian conservation of continuous quantity test with Senegalese children aged 6 to 13, Greenfield (1966) concluded that age is directly related to conservation of quantity for school children. Her conclusion holds for both rural and urban school children but not for unschooled rural children.

In their study of sorting by color or function among Ugandans of a variety of ages, education, and degrees of urbanization Evans and Segall (1969) suggest that experience (urban and education) affected their findings more than age. Their sample included older adolescents and adults, unschooled or with low education, as well as primary school children.

The perceptual task of identifying screen action is less cognitively complex than sorting or conserving. The three diverse studies cited above agree that schooling had a positive effect on their results but the role of age is left in some doubt--particularly for educated middle and older adolescents when perceptual development may have stabilized. The phenomenon of the overage, less able pupil unable to perform to the same level as his or her classmates was mentioned by Evans and Segall (1969) as a possible clue to intelligence factors at work. Whether or not some form of general intelligence is a strong factor in a filmic comprehension task must await better evaluative instruments than those currently available.

The assumption made in this study is that perceptual development is changed by both maturation and education and affects responses to various perceptual tests including filmic comprehension but that the linkages between the tests are unknown in the same way that the perceptual process for each test is not clearly understood.

Viewer Characteristics: Prior Film Viewing Experience

Several writers (Forsdale & Forsdale, 1966; Hoban & van Ormer, 1950) have used the term "film literacy" to refer to a person's facility with the conventions used to create a motion picture and the ability to glean from a film the director's intended meaning. Film literacy has been expanded recently to "visual literacy" (cf. Williams & Debes, 1970) in order to accommodate pictorial materials as well as films and television.

Virtually no research has systematically examined the relationship between prior viewing experience and a person's filmic comprehension. In the media-rich nations, controlling for this variable would be virtually impossible. The most direct examination of the issue has been by Snow (1963) in his comprehensive study of various audience and film characteristics. Scrutinizing the performance of 437 American college physics students after a semester's exposure to films, and the students' film viewing habits, Snow (1963) concluded:

> Past experience with instructional films, as measured by self-reported past use of the Purdue Film Library, results in higher retention of material learned from films rather than from conventional instruction. This effect of past use of films, while not significantly related to overall immediate recall performance, is of import in the later stages of practice in learning from a series of instructional films . . . .For some of the films used, frequent past experience with entertainment films is associated with higher immediate recall learning from those films than from conventional presentation of the same material [p. 111].

Mercer (1952) used a one-shot illustrated lecture approach to discuss cinematic techniques in an attempt to raise the level of film literacy of a group of United States Air Force subjects. The subjects took a film literacy test, viewed a factual film, and responded to a posttest of the film's content. There was a small (.33) correlation between scores on the film literacy test and scores on the posttest with intelligence scores partialled out. The lecture on cinematic techniques did not improve the scores on the posttest compared with a no-lecture control groups.

Previous citations (Huxley, 1931; Spurr, 1954) have indicated that African audiences viewing films for the first time seem to clearly understand the screen's action though not the story line, the conventions of editing, and optical effects. The assumption can be confidently made that urban audiences have greater access to film shows than rural audiences in Tanzania. Precisely what effects this viewing practice would have in relation to other audience and filmic variables is unclear. The expectation would naturally be that there would be a strong positive relationship between film viewing and filmic comprehension. Dawson (1967) found that formal training in depth perception improved Sierra Leone secondary school leavers' abilities in pictorial perception.

It is characteristic of Tanzanian film shows that the audience converses openly about the film's action, as Powdermaker (1962) also observed in Zambia. Conversations she recorded indicate the active search viewers engage in to glean meaning from the screen and the verbal interaction between them. Is this a form of informal screen education? Probably so, although misconceptions can be reinforced as

Powdermaker (1962) reports. For those using educational films, knowledge of the audience's prior film experience and its influence on comprehension may be necessary for successful instruction.

Methodological Considerations

Four general classes of film study have been identified by Hovland, Lumsdaine and Sheffield (1949) at the beginning of the film research era following World War II. Their categories are: evaluation of a single film, evaluation of a class of films, experimental investigation of a single variable by controlled variation, and experimental analysis of two or more variables in combination. They predicted: ". . . the type of research that will probably result in the broadest generalizations for the field of educational films and related media is research studying the controlled variation of several variables in combination [p. 8]." The decision to use this latter class of film study is clearly desirable but at the same time presents hard choices since it is apparent that a film is composed of many complex variables.

Since the lack of systematic research on the motion picture's basic elements was apparent from reviewing various sources, it is logical to concentrate on the skeletal members which remain constant from film to film. These skeletal members--the perceptual elements--are generally independent of content, the logic of the content's presentation, and the manipulation of time and space through editing practices. The decision to ignore the cognitive and affective variables of story and editing and concentrate on perceptual variables is especially justified when there is little known about the viewer's characteristics. What emerges from the cinema's own internal logic is actually a systematic sequence of research which begins with the basic elements and gradually moves up a hierarchy (cf. Forgus, 1966; Gagné, 1965) to include ever more complex cognitive and affective empirical questions.

The limitations of interpreting interaction results as well as practical limitations of administering and analyzing tests place restrictions on the number of variables which can be combined in an experimental design. Lumsdaine (1963) argues for simple designs and greater attention to proper randomization to "obviate the need for highly refined methods of statistical analysis [p. 604]." Proper randomization usually rules out the testing of intact groups unless the groups are treated as units--an alternative suggested by Hovland et al. (1949). Since an important reason for this study's existence was relevance to the Tanzanian situation, showing the stimulus materials in a realistic setting to intact groups, i.e. primary school classes, was considered a vital part of the study's external validity.

In order to eliminate editing and content variables, it is clear that only shots projected singly (defined in Chapter 1) can control for effects of editing and the interference which results from separate images combined over time into what is generally referred to as a sequence of shots. Selection of the shot as the primary stimulus form is apparently unconventional until recently in film research. Utz (1969) used ten film clips varying from 7 to 39 seconds to test perceived reality of black and white vs. color. Baldwin (1968) used ten shots of 4 seconds each from a longer film to test for audio or visual dominance by recall. The shots were shown consecutively with only a brief pause between each shot. Responses were solicited after all ten shots were screened.

It has been noted throughout this chapter that the lack of research on films in Africa forced an examination of other perceptual data presumed related in some manner to the perceptual questions raised by this study. Much of the other data came from pictorial perception research.

An extension of the pictorial image over time is, of course, the filmic shot. By using the shot with a pause following its projection for the subjects to respond it is possible to isolate the elements under examination. This immediately suggests future research which might begin to link perceptual hierarchies along a continuum of perceptual cues using, for instance, Gibson's (1950) listing of 13 varieties of perspective. These different varieties include static as well as motion components. Indeed, it would be interesting to see the results of a modified Hudson's (1960) test using animation to provide a motion cue.

Mialaret (1966) has provided insight into an area often overlooked or not reported in film research: the content itself as a determinant of filmic comprehension. He observes, discussing the primary school child:

> In the extreme case he sees a world which may be real but is completely strange to him. Comprehension is no longer at the levels at which it was previously situated. He no longer enters wholeheartedly into the action. He has to recognize or even discover the reality and significance of objects. All the gestures have to be interpreted and related back to an infrastructure of knowledge he does not always possess (because he lacks the necessary sociological or historical background, for example) [p. 179].

From this warning, it is clear that the actual content of the stimulus materials should be readily identifiable. Otherwise the variable under analysis is the pupils' identification of the content confounded with the filmic treatment of the content.

Psychological testing in Africa has been discussed by Schwarz (1963), Irvine (1965), and Vernon (1969). All of them point to the unfamiliarity of African school children with such tests and the need to teach pupils how to respond to various novel tasks before administering a test. Doob (1961) reported finding incomplete or one word answers when people were presented with photographs of very familiar scenes when, in fact, he knew they clearly understood the action and the objects. Doob (1961) suggests that the explanation may be in the technique of presentation rather than any inability to comprehend the pictures. This suggestion is supported by Collier (1967) under similar circumstances in Peru. These are indications that a form of structured response would be desirable although a total forced choice response would not provide the necessary insight into how the pupils comprehended the stimulus materials.

From the evidence cited--and the lack of evidence--there are many open questions about the nature of filmic comprehension in Tanzania and elsewhere. Several reasons emerge which justify conducting film research in Tanzania beyond the fact that no systematic findings are available. First is the immediate use of such research as the government expands the film and other educational media production facilities. Another reason is that a wide variety of audience characteristics provides useful data for tailoring films to fit various categories of viewers--age level, prior film viewing experience, and geographic location. A final reason is that data on perceptual tasks are available from other African nations. These data can be used for developing educational plans and teacher training strategies. Such data are not presently available from Tanzania. Hopefully, this study will stimulate others to fill the present void in Tanzania's educational and psychological research.

Chapter 3

Methods and Procedures

Hypotheses

The following null hypotheses based on past research, perceptual theory, and the need for developing relevant message design suggestions for Tanzanian filmmakers, were considered appropriate for the investigation's purposes:

H_1: Chroma. There will be no significant difference between the comprehension of color rendered and achromatically rendered filmic stimuli.

H_2: Camera Mode. There will be no significant difference between the comprehension of animated and live action filmic stimuli.

H_3: Background. There will be no significant difference between the comprehension of filmic stimuli with low background information levels and those with high background information levels.

H_4: Audio. There will be no significant difference between the comprehension of filmic stimuli with no associated sound and those accompanied by appropriate sound effects.

The above hypotheses are referred to as the filmic hypotheses. The following are referred to as the population hypotheses.

H_5: Geography. There will be no significant difference between the comprehension of filmic stimuli by rural-dwelling primary school children and urban-dwelling primary school children.

H_6: Sex. There will be no significant difference between the comprehension of filmic stimuli by male and female respondents.

H_7: Age. There will be no significant difference in the comprehension of filmic stimuli by various age levels.

H_8: Viewing Experience. There will be no significant difference in the comprehension of filmic stimuli by respondents having various past viewing experiences.

Research Design

The theoretical approach, the nature of the basic film elements selected for investigation, and the subsequent hypotheses indicated that a 2^n complete factorial experiment would be the appropriate design (Edwards, 1960, Chapters 12 and 13; Winer, 1962, Chapter 5). This design, while requiring a large number of subjects, is efficient in evaluating the effects of several treatments on filmic comprehension --the dependent variable--because all subjects are used in evaluating the treatment effects. In addition, interaction effects can be evaluated. With the large number of two-factor treatment levels involved in this investigation, the interaction possibilities are recognized as a decided risk in forming simple conclusions (Kirk, 1968, p. 242).

The number of dichotomous, two level treatments indicated by the hypotheses could be six (four filmic plus geography and sex). However, the difficulty of maintaining approximately equal cell sizes for the sex factor when using intact classes mitigated against including sex in a 2^n design. This is because there are generally fewer females than males in Tanzanian primary schools. Mbilinyi (1969, p. 13) reports the average national ratio for primary schools as 1.6 males to 1 female for 1967-1968. The experiment is thus based on a 2^5 (2 x 2 x 2 x 2 x 2) factorial design with four controlled filmic treatment variables and one controlled population variable (geography). A diagramatic, isometric rendering of this design is indicated in Figure 1. When laid out in a more statistically manageable diagram, the design appears as Figure 2. In this design, all cells are independent of one another, i.e., not nested. There is arbitrary assignment of the factors to positions in the design.

The number of main effects and interactions possible with this 2^5 design is 31. In later analyses, strong efforts would be made to eliminate at least one treatment level which showed no significant main effect and minimal interaction effects, thus simplifying the interpretation of results.

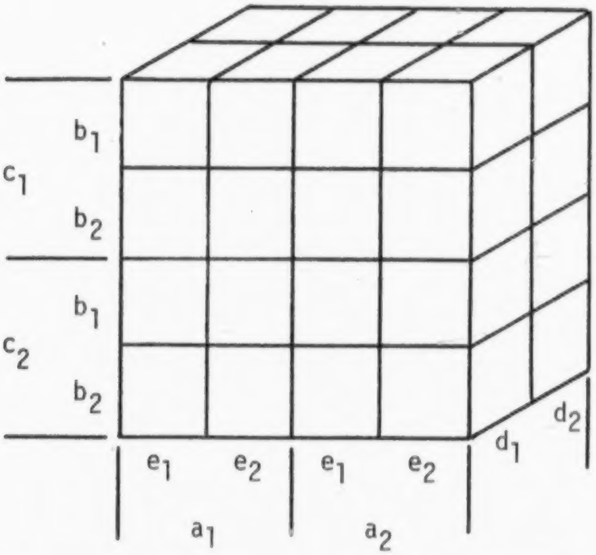
Subjects

The subject population originally selected were the pupils in the final grade of the Tanzanian primary schools, Standard 7. While this population will not be exposed to films as part of their education in the primary schools for some time, there are several reasons for developing insights into this group's filmic comprehension:

1. Some 10% will go on for further education where films are used for educational purposes. Moderate extrapolation of the study's results to this group could be justified.

2. The national policy is to encourage rural primary school

Figure 1. Isometric view of 2^5 factorial design


b_1
c_1
b_2
b_1
c_2
b_2
e_1
e_2
e_1
e_2
a_1
a_2
d_1
d_2

A: Chroma

B: Background

C: Camera mode

D: Geography

E: Audio

Figure 2. Layout of 2^5 factorial design

	e_1								e_2							
	d_1				d_2				d_1				d_2			
	c_1		c_2		c_1		c_2		c_1		c_2		c_1		c_2	
	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2	b_1	b_2
a_1																
a_2																

leavers to remain in their home areas and use their education to become good farmers. As a result there is an increase in district level farmer training centers and agricultural extension activity--which presently includes the use of motion pictures as an instructional medium.

3. Because this group is composed of adolescents mostly between the ages of 13 and 16, their perceptual development with respect to film viewing is assumed to have stabilized. This assumption could not be made of much younger children, while older youth with the same education level have been dispersed.

4. These pupils have had nearly seven years of formal education. Their knowledge of Swahili (Tanzania's national language and the language used throughout the field testing) was more than adequate for the simple descriptive task required in the testing procedure.

The total subject population consisted of approximately 16,000 Standard 7 pupils and an estimated 18,000 Standard 6 pupils (the necessity for the use of some Standard 6 classes is explained below) for a total of 34,000 pupils in the four regions. This four region total represents about 29% of the national total for the two standards.[1]

Research in Tanzania is limited to certain regions because of security considerations. These limitations, as well as practical reasons, meant that not all parts of the country could be sampled. The testing was conducted during normal school hours in 4 of the 17 regions: Arusha, Coast, Kilimanjaro, and Morogoro during January, February, and

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[1] Extrapolated from figures in Tanzania. Second Five Year Plan, Vol. 1; and Standard (Tanzania), Feburary 6, 1970.

March, 1971. A total of 16 schools was visited, 4 per region; 8 schools in the regional centers, 8 schools in rural areas.

Selection of the sample was based on the principle of testing in all the various types of primary schools. Random selection of pupils had been ruled out as impractical and random selection of schools was impossible because of time and travel considerations (the area of the four regions is roughly equivalent to the states of New York and Pennsylvania combined). The selection of the sample included the following types of schools:

--Large urban schools
--Small urban schools
--Boys boarding schools (urban and rural)
--Girls boarding schools (rural)
--Rural schools with access to town
--Isolated rural schools

These categories were discussed with Regional Education Officers (R.E.O.), who then suggested the specific schools used for testing. Bias may enter because of selection by R.E.O.s of better organized schools with higher quality staff and pupils, and politically active schools. Results of the study might reflect this bias if filmic comprehension is related to these characteristics. However, it is the investigator's opinion that the total sample is a fair reflection of the various types of primary schools in the four regions. A brief description of the schools and the regions is included in Appendix 3. Table 1 gives a numerical summary of the subject characteristics.

Intact classes were used for testing. The use of intact

TABLE 1

Subject Data

	Total	Sex		Age	Standard		School Location	
	N	M	F	(mean)	6	7	Ur.	Ru.
Total	1,267							
Sex								
Male	827							
Female	440							
Age (mean)	14.6	15.0	13.9					
Standard								
6	353	219	134	14.1				
7	914	608	306	14.8				
School Location								
Urban	715	442	273	14.2	134	581		
Rural	552	385	167	15.2	219	333		
Region								
Arusha	280	164	116	14.4	114	166	137	143
Coast	388	259	129	14.6	135	253	215	173
Kilimanjaro	278	154	124	14.2	48	230	178	100
Morogoro	321	250	71	15.1	56	265	185	136

classes allowed minimum disruption to the school, retained a realistic setting for the testing procedure, and provided the large number of subjects per cell which the design required. A disadvantage is the range in intact class sizes (range: 19 to 54). The average number per class was 39.6 pupils. The total N was 1,362. Because of voided responses and duplicated treatments, the final N = 1,267.[2]

Normally, classes would be assigned at random to the treatment combinations. Simple random assignment resulted in a disproportion in the class distribution with respect to regional representation. A regional effect was not part of the formal investigation and no hypothesis was drawn up to examine it. The decision was made that balancing the assignment of schools to treatments on a regional basis would minimize possible regional bias if it were to occur. Before assigning the schools to particular treatment combinations, each of the 32 cells was given a regional number arranged in such a way that the vairous comparisons between treatment levels would have regional balance. Classes were then randomly assigned to the treatments with the regional stipulation.

This intended balance was partially upset by administrative problems. Because of an error in administering one test in which the audio mode was used incorrectly, and a faulty connection in the sound system for another test, two tests in Kilimanjaro Region were not used in the final sample. One school in Coast Region did not have the expected two classes. The solution to the problem of three lost tests was to add more weight to the Coast Region. One large rural Coast Region school had all four of its Standard 6 and 7 classes tested rather than the usual two in order to make up for two missing rural tests. An additional urban class was tested in Coast Region to make up for a missing urban test. This regional imbalance necessitated calculating a correlation between region and scores on the dependent variable.

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[2] Reasons for the voiding (eight subjects) were based on not completing the task, illegibility of hand writing, and not writing correct test number (a check on eyesight). Duplicated treatments are discussed later.

A further stipulation was necessary to insure independence between treatment groups during the testing procedure. Since the sound effects used in the audio treatment would be audible from classroom to classroom, one class from each school was assigned to a "silent" treatment and would be tested first. The second class to be tested would receive the "sound" treatment. The regional and audio specifications placed on the assignment of groups to the 32 treatment combinations do not violate the principle of unbiased treatment assignment assumed in the statistical analysis. The specifications insure fair and equal representation of regional considerations and independence between groups.

No remuneration was given to the respondents. It was announced before the testing that several films would be shown following the testing. A selection was made from films on nature and athletic subjects made in Tanzania by the investigator and a film produced by Castle films from NASA footage of the Apollo 11 moon landing.

Tribal and Ethnic Origin

Doob's admonition (1965, p. 375) to identify exact ethnic and cultural backgrounds (i.e., tribal group) when reporting results of psychological investigations is acknowledged, but not acted upon except to give rough identification in Appendix 3 of the tribal makeup of the area surrounding the school. Without obtaining further personal data from each respondent such as both parents' tribe, past dwelling places, mother tongue, parents' education, socio-economic background, actual years in school in addition to present Standard, scholastic achievement, etc. gross tribal affiliation (particularly with urban respondents) is considered potentially misleading in interpreting results of this investigation. Only after obtaining such information, which was considered outside the scope of this investigation, could a factor analysis be applied to the data to secure any insights into tribal effects on filmic comprehension. All of this further personal information would be highly desirable in providing greater insight into the organismic factors affecting filmic comprehension but was not possible to obtain without direct personal interviews of all respondents.

There was a reason beyond the practical difficulty of collecting the pertinent information. Tanzania's post-independence policies and goals have aimed at erasing differences which separate people into groups based on religion, skin color, ethnicity, and social class. While such factors affect people's behavior, they also cause undesirable separation among peoples. The investigator feels strongly that where a factor such as tribal origin is not considered relevant in scientific research it should be ignored, since the mere appearance on a questionnaire gives it significance out of proportion to any small gain in scientific understanding. Thus the inclusion of a tribal origin question on the questionnaire was never raised with Tanzanian officials. The investigator takes full responsibility in deciding not to include any such item in the questionnaire or as a covariate in the data analysis.

Those readers familiar with Tanzania would wonder about the number of non-Africans included in the sample. Only 15 respondents in the final sample were of Indo-Pakistani background.[3] No separate analysis was made of the answers of these non-African respondents, who were scattered through several urban schools used in the testing. One class of pupils almost exclusively of Indo-Pakistani origin was tested but because their language of instruction was English, whereas all other testing and scoring was based on Swahili, their results were not used in the final sample.

Preparation of Stimulus Material

Design of the stimulus materials was guided by the perceptual theory and film research considerations discussed in Chapter 2. Stimulus content was selected on the basis of various criteria:

--Filmic variables rather than content variables were being tested. The content must be immediately recognizable to the subject population (irrespective of region or school location) if presented to it as live, natural action.

--The content must have a distinctive sound in order to test the audio effect.

--The content should have repetitive action to facilitate animation and camera technique.

--The beginning of the shot must present the same content as the end for such camera techniques as zoom-in, zoom-out, tilt-up, tilt-down, etc.

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[3] Analysis of their responses indicated no systematic difference compared with the main sample group.

--The content should be capable of accurate, unambiguous description in written Swahili in a single sentence.

--The actions should reflect practical events which have an agricultural, vocational, or public health content.

Five actions were selected which met the above criteria and were used for the indicated camera techniques.

--Hammering a nail into a board (zoom-in, zoom-out, close-up)

--Sawing a board with a hand saw (tilt-up, tilt-down, medium shot)

--Using a jembe or large hoe (long shot)

--Sweeping bare earth (high-angle)

--Riding a bicycle (pan)

Three of the actions were used more than once in order to allow comparison between certain camera techniques. Normal procedure calls for selection of the actions from a pool of possible actions through the use of a pre-test. Because of delays in receiving permission to test in the classroom this was not possible. Informal tests revealed nearly unanimous recognition of the main objects by children younger than the subject population. Four (saw, hammer, bicycle, and jembe) received nearly 100% recognition when pen and ink drawings of the objects without context were shown to a large number of different age, education, and geographic groups in Kenya (Shaw, 1969, pp. 32-33). Kenya is Tanzania's neighbor to the north. Out of 226 responses to the four pictorial objects among Standard 6 and 7 pupils, 7 indicated they did not know and 4 made incorrect responses for a total of 11 misses (9 were from Standard 6 subjects, 2 from

Standard 7 out of totals of 170 and 56 respectively). Presumably scale and action context would have raised the response rate since jembe and axe were confused by some in the Kenya study. The sweeping action is an everyday activity in all primary schools in Tanzania as well as in most homes. Thus it was assumed that all the actions would be equally highly recognizable and therefore actions *per se* were not employed as the independent variable. Rather each subject viewed all five actions in each test.

The camera techniques selected for portraying the actions included the commonly used long, medium, and closeup, zoom-in and zoom-out (similar in effect to the truck-in and truck-out), tilt-down and tilt-up, pan with moving subject, and high-angle above subject. The high-angle camera position was also the basis for the short duration shot which was 2 1/2 seconds or half of the 5 seconds standardized for all other shots. The short duration shot was included to provide information on whether duration time of a shot is related to other elements, for use in future research on editing procedures.

The decision to use five seconds as shot length was based on several considerations:

1. The investigator's observation of recognition time for these and other familiar actions in showing films to audiences younger than the subject population.

2. Longer periods of time spent on viewing repetitive actions were observed to lead to verbal comments about what was occuring, i.e., interaction between subjects.

3. A long duration shot would possibly weaken discrimination of variables contributing to filmic comprehension.

The production strategy was to film various actions against complex and plain backgrounds in the live action condition using color film. The animation materials were then developed by producing tracings from these live action sequences using an editing viewer. The tracing process insured that sizes and perspectives were similar for both modes. Black and white and color copies were made from the original footage. All filming was done by the investigator in Tanzania with a Canon 814 super 8mm camera using Ektachrome II film. Lighting was flat minimal shadowed daylight, except for the hammering and sweeping with complex background where there was discernable shadowing. The zoom shots used the camera lens' full 7.5 to 60mm (1:8) zoom capacity.

It was observed by the investigator from previous film shows to the target age group in Tanzania that females appearing in films elicited greater spontaneous verbal response than males. It was therefore decided to film all the actions with male talent in order to minimize possible interaction during testing. The use of male actors was, in fact, consistent with the nature of the actions since three of the five stimulus actions are usually associated with males in a society where male and female roles are often carefully preserved. The jembe and sweeping actions might be performed by either sex while bicycle riding and the two carpentry actions are decidedly male activities. With the exception of the hammering with complex background, two young Tanzanian males of the same age as the subject population performed the stimulus actions. They were dressed in short sleeved shirts and shorts as is characteristic of that age group attending primary school. The hammering with complex background shots were made with a mature Tanzanian male dressed in a white shirt and long trousers.

The animation artwork was first outlined on tracing paper using an Erics super 8 editing viewer with a viewing area 4 1/2 x 6 1/2 inches (11.25 x 16.25 cm). This machine was modified to accept a two pin registration peg assembly. Various layers of cels for depicting movement were drawn in color on acetate sheets and a crude but functional animation stand was constructed for using the Canon 814 super 8mm camera as the animation camera. A travelling peg bar was made for the pan and tilt shots. The camera's zoom lens control facilitated zoom shots after calibration for single framing. The artwork and animation cinematography were done by the investigator. Photographs illustrating this operation are included in Appendix 4. Black and white photographs of the various live action and animated film shots are found in Appendix 5.

The animation artwork was designed to fairly represent both the live action shots and the type of artwork which would be familiar to the subject population through their teachers' sketches, government posters, text book illustrations, and other local sources for illustrative artwork. The difference between a photograph and an artistic illustration of the same subject matter can range from indistinguishable to quite abrupt depending on detail, faithfulness to gradation, etc. No attempt was made to duplicate fine detail or portray shadowing with great accuracy. Background rendering was made with watercolor paint and some artistic license was inevitable. Great precision in the artistic illustration was, in fact, not desirable. The purpose was to compare the more simple, less detailed animation camera condition which emphasizes form over detail with the highly detailed, realistic rendering of live action cinematography. Thus, the guidelines for artistically portraying the subject matter were a mixture of common animation artistic practice and scientific precision through the use of traced sketches from the live action footage. Strictly speaking, the results of this and other studies apply only to the stimulus materials used in the study but all filming, live action and animation, was done in such a way that it was consistent with cinematographic practice found in most educational films.

Sound effects were recorded on a Toshiba Kt-20p cassette tape recorder using that recorder's microphone. It was decided to use the sound effects "wild" or unsynchronized rather than synchronized since the difficulties and further equipment expenses for synchronized sound--even with magnetic striped super 8mm--would be greater than the anticipated benefits. This choice is an open question and a calculated risk was taken based on the comparatively short duration of the test shots. It was felt that a short period of slightly unsynchronized sound directly related to the visual content would not be detrimental to the results.

All sounds were made by the objects and actions themselves with the exception of the jembe where a shovel with a wider bite gave a louder sound of the same nature--steel entering the ground. The bicycle was represented by a ringing bicycle bell--a common and distinctive sound in Tanzania. Some ambiguity between the jembe and hammering was identified when these sound effects were informally pretested. The ambiguity was attributed to the fact that they were generic sounds of a metallic object making an impact. Strictly speaking, selecting the jembe and hammering actions was a slight departure from the selection criterion of requiring distinctive sounds but the visual universality of the objects was felt strong enough to overcome the imprecision of the audio ambiguity.

The procedure for assembling the tests was as follows:

1. Each of the ten different camera techniques (zoom-in, pan, etc.) was assigned a number.

2. Thirty-two sets of ten random numbers (1-10) each were drawn from a random numbers table. These sets were the order of showing of the camera techniques.

3. Because certain actions were repeated in a set of ten, a restriction was placed on the sets that no two identical actions would be allowed to follow each other. Those sets where two actions were together were modified by returning to the random numbers table for another drawing. This means, for example, that a zoom-in would not follow a close-up since both are hammering actions.

The result was a randomly ordered set of film shots for each of the 32 cells in the overall design (16 for the urban sample and 16 for the rural sample). The purpose was to minimize order or learning effects. It should be carefully observed that this consideration is irrelevant given the hypotheses of this study since they are not concerned with filmic comprehension as a function of camera technique. The randomizing was done in case later analysis of camera techniques might prove desirable. In effect, the study provides a test of the actions and camera variables as a repeated measures design. However, in analysis of the data, this repeated measures aspect is collapsed into a single score for each subject to retain a pure factorial design.

Instrument

A single page questionnaire was generated in order to gather the written personal data and responses to the stimulus material. This questionnaire was in two versions which differed only in questions related to previous urban residence--one version for rural schools and the other for urban schools. Copies of the questionnaires are included in Appendix 6.

A rough measure of the pupils' position in the classroom was obtained by dividing the classroom seating into a grid of columns and rows. The questionnaire contained a series of letters (column) and then a series of numbers (row). The pupils were instructed on how to mark their location by circling the proper letter and number corresponding to their location in the classroom. This data was gathered as a check on a subject's score on the dependent variable as a function of seating position. It also allowed comparison of scores between neighbors as a check on possible subject interaction.

A vision check was made using the phrase: "ANDIKA NUMBA ____". This means "Write number ____". The respondents were asked to look at the screen and write the number they saw in the place provided. The design's cell number (1-32) was placed at the beginning of that class's particular roll of test shots. The number was white on a black background. The screen size of the number (about 2 inches or 5 cm) was estimated to be about the size of the smallest object or significant part of an object necessary for a correct response to the test stimuli.

Several purposes were involved in having the subjects write the cell number. First, it was a check on the subjects' ability to see what was on the screen. Second, it directed the subjects' attention from the investigator seated at the projector to the screen. Third, it conditioned the respondents to seeing an image on the screen for a short time (five seconds) and then writing what was viewed. Fourth, because it was a simple task, it served to build the subjects' confidence in performing the test's task of responding to projected stimuli. A wrong response would alert the investigator to a possible vision or seating problem, or a misunderstanding of the task.

Departure from the normal procedure of pre-testing the instrument was forced by delay in receiving permission to test in the schools. Informal assessment by the investigator's colleagues did not indicate a problem which later arose with the wording of one question (urban school version, length of residence in town). This question was subsequently dropped. The lost information was not crucial to the study, however, since very few pupils in the urban sample lived less than a year in a town and most had attended the same school for three or more years. No other questions about personal data produced ambiguous responses, though the seat location precision varied with classroom arrangement.

Equipment for Field Testing

The first task in administering the test was setting up the equipment. Since few Tanzanian primary schools--even in urban areas --have electricity, a small Honda 300 watt generator (Model 300U, 240 volts at 50 cycles) was used for the projector's power. The Eumig Mark 8 silent projector, equipped with a 12 volt, 100 watt quartz halogen lamp and 18-30 mm f/1.6 zoom lens, was placed on a centrally positioned 28 inch (71 cm) high folding table approximately 7 to 9 feet (2.2 - 2.8 m) from the front of the room.

A Kodak Ektalite screen (40 x 40 inches or 1 x 1 m) was placed in the front of the room, equidistant from the sides of the room. Nearly all rooms used for testing were the standard 20 x 30 feet (6.1 x 9.5 m) size. This screen has a highly reflective, aluminum foil surface and is highly directional both vertically and horizontally. It was either supported by a wall hook or a portable frame, depending upon classroom circumstances. Kodak recommends that the bottom edge of the screen be placed slightly above eye level. This specification was followed. Prior to testing, the projector's lamp was turned on and the screen adjusted for maximum projection efficiency for seated viewers. Adjustments in seating on the sides of the room were made when necessary. Since testing was conducted during ordinary school hours and most primary schools are designed for maximum ventilation, it had been anticipated that classroom darkening would prove a difficult problem. In fact, only windows admitting direct sunlight were darkened with heavy dark green plastic sheeting. The screen's rejection of extraneous light from the sides and ceiling of the classroom greatly facilitated testing under near normal classroom lighting with a minimal disruption of the normal classroom environment.

Ambient illumination was measured at the screen with a Gossen Luna-Pro photographic light meter with the incident reading dome in place. The range in ambient illumination at the screen was from a low of approximately 0.37 footcandles to a high of 65 footcandles (5 1/2 to 13 on the Gossen's scale). A Pearson product-moment correlation calculated with 32 cell means vs. ambient illumination during testing yielded $r_p = .15$, not significant, indicating no relationship between ambient illumination and cell means. Photographs taken during the film show following the testing are included in Appendix 4 and illustrate the classroom environment and image projection.

The cassette tape recorder was placed near the projector and its output fed into a small battery powered three watt amplifier-radio (National R-241) which sent the sound into an eight inch (20 cm) speaker placed just under the screen. There was no control over the acoustics of the classrooms. The more rugged classrooms often lacked ceilings and only the usual corrugated iron roof and its structure were overhead. The front and back walls were hard surfaced--generally white plastered block. The floors were smooth concrete. Some schools had casement windows on both sides while many had large window openings covered typically with steel mesh. Since the number of subjects ranged from 19 in the smallest class to 54 in the largest, there was variation in the amount of sound absorption by human presence. Ambient sounds were not a great problem since most schools are built away from main roads, and discipline--imposed and self-generated--is quite strict, at least when a guest is present. There was never an occasion to interrupt the testing because of outside sounds. The generator was put some distance away behind the classroom's front wall and, while a distinct noise source, was constant in intensity.

An attempt was made to set up the equipment before school began in the morning or during the lunch break in order to minimize confusion. The pupils generally waited outside the classroom until the equipment was in place (approximately 20 minutes was required for this). They then entered and were instructed to sit as they normally would.

Questionnaire Administration

The pupils' teacher was usually present during the testing and assisted the investigator in explaining the personal data questions. Before the questionnaire was handed out, a short prepared statement about the general aims of the investigation and the role motion pictures were expected to play in the nation's development was read by a volunteer from among the pupils. A brief description of the questionnaire and the testing was included. Stress was placed on the fact that this was not an examination or test such as they had taken before and that results did not affect their academic standing. It was compared to a fumbo or puzzle rather than a mtihani or examination. Following the pupil's reading of the introduction--designed to give the investigator rough insight into the level of reading Swahili in the school--it was announced that a film show would be given after the testing procedure. The questionnaires were then handed out.

The pupils were instructed to answer the various questions to the best of their knowledge. Since this kind of experimental activity is infrequent in Tanzanian schools, the teacher and the investigator walked about the room spot checking the responses and clarifying what was expected of the pupils. Some pupils were unfamiliar with the "check the appropriate response" type of question. When necessary, the meaning was clarified using the chalkboard. They were instructed how to indicate their seating position, and this completed the personal data part of the questionnaire.

The lower portion of the form contained a summary of the instructions on responding to the stimulus materials. These were read aloud by the investigator.

Task Training

The next phase was a lesson in looking at a picture and describing the central action. The purpose was to prepare or coach the pupils in the form for answering the general question, "What have you seen." Four examples were used, which took the form of large pen and ink drawings held up before the class. The actions used in these drawings included a girl reading a book, a boy kicking a soccer ball, a woman washing a pot, and a young man cutting up a fallen log with an axe. They were drawn by a distinguished Tanzanian artist and are included in Appendix 5.

The task training was a crucial phase in preparing the pupils to correctly and fully respond to the test stimuli. A typical dialogue between the investigator and the pupils is reproduced here. The dialogue illustrates the method of shaping the verbal response to the pictorial stimuli (examples) which was expected to be transferred to the filmic stimuli (test). The purpose was to train the pupils to respond to all the relevant data in the stimuli and verbalize these responses in a specific manner when answering the question, "What do you see?" The approximate English translation follows the Swahili.

Investigator: [holding first example drawing] Unaona nini? (What do you see.)

First pupil: Anasoma. (He/she is reading.)

I: [writes "anasoma" on chalkboard] Sawa, lakini nani anasoma? (Right, but who is reading.)

Second pupil: Msichana. (a girl.)

I: Msichana anasoma. (A girl is reading.) [Writes "msichana" in front of "anasoma" on chalkboard.] Msichana anasoma nini--gazeti, barua--nini? (What is the girl reading--a newspaper, a letter--what?)

Third pupil: Msichana anasoma kitabu. (The girl is reading a book.)

I: [with enthusiasm] Vizuri sana! Msichana anasoma k-i-t-a-b-u. [writes out "kitabu" on chalkboard.] Sasa uandike jibu hili kwa mfano wa kwanza: Msichana anasoma kitabu. (Now you should write this answer for the first example: A girl is reading a book.) Umejibu swali hili: Nani anafanya nini na akitumia vitu au kitu gani? (You have answered this question: Who is doing what and using what sort of thing or things?"

All pupils wrote the answer to the first example and the lesson continued. The last two examples were written first and discussed afterward. This coaching follows the general testing recommendations in Vernon (1969, Chapter XVI).

Completing the personal information and task training parts generally took thirty minutes. Attention then went from the examples and the investigator to the screen by way of projecting the simple vision test number on the screen. The pupils were instructed that the test would begin and were reminded to answer the question, "Who is doing what and using what sort of thing(s)?" in making their responses.

Testing Procedure

The projector was turned on and the first item was shown. The projector was turned off after the black leader separating each test item appeared. The item order was randomized over the 32 separate test groups. The pupils wrote their responses; adequate time was given for all to finish. If the test had sound effects associated with the items, the cassette tape recorder was turned on by the investigator using a remote control switch at the same time the visual image came up on the screen. The machine was turned off when the screen went black. There were separate tape cassettes for each sound and these were changed during the time the pupils were writing. During the tests with sound effects, it was noted that there was often synchronization of at least one or more times with the impact sounds --_jembe_ and hammer. For sweeping, bicycle and saw, synchronization was not crucial since there was nearly constant movement with constant sound.

Following projection of the fifth item, the question, "Who is doing what and using what sort of thing or things?" was repeated. The remaining five items were then projected without comment. The investigator and the teacher were alert for copying during the testing but some isolated incidents probably resulted given the close proximity of the pupils in most classrooms. The actual testing time was generally 15-20 minutes. Following the first testing session in a school, the pupils filed out of the room after the questionnaires were collected and another group immediately took their places for the second testing session. There was little, if any, opportunity for interaction between the two groups. The process was repeated and the promised film show was put on for the combined classes. As might be expected, that was a rich experience for both the investigator and the pupils, who do not have the opportunity to see films often. The pupils and teachers were thanked for their participation.

The total time usually consumed in administering the questionnaire, explaining the examples, and testing a class was 50 minutes. The film show at the end was approximately 35-40 minutes. While it had been hoped to test only at a particular time during the day (beginning in the first school period at 8:30 a.m.), this was not always possible. Eight out of the 32 classes were tested beginning with the first period after lunch--2:00 p.m. The first testing was in Arusha town on January 28, 1971, and the last on March 20, 1971, at Vikindu Primary School in the Coast Region.

Scoring Responses

In collaboration with two Tanzanians (one from Tanga Region, the other from Kilimanjaro Region), a scoring scheme was devised which considered the following guidelines:

--benefit of the doubt would be given to the pupil where the response had inaccurate spelling, grammar, and, within limits, vocabulary.

--where certain ambiguities arose in the stimulus materials, scoring would be less rigid than in unambiguous cases. For example, the actor's gender would be indeterminable for the hammering close-ups where only the actor's hands were visible.

--since the Swahili language has some minor regional differences in vocabulary, the scoring would not be prejudicial to one region.

--since the four task training examples attempted to structure a response, the scoring would be based on evaluating the subject, verb, and objects mentioned by the respondents.

The stimulus shots were reviewed by the investigator and his Tanzanian colleagues and a model answer for each shot was devised. In some cases, there was a difference in precision of answer between the two camera mode categories of animation and live action. Greater flexibility of scoring was generally given to the animation shots, particularly with respect to the age designation of the actor, and in a few instances, objects used.

A set of points was assigned each model answer which was uniform for each action, regardless of filmic mode. A perfect score for the ten stimulus shots was 79 points. Sampling some of the responses confirmed model answers and drew attention to variations from them. Judgements were made as to points given deviations. The use of two points for each correct subject, verb, or object permitted partial credit for less precise designations (e.g., a man = 2 points; a person = 1 point). From these a scoring table was devised for each action. These tables are included in Appendix 6. A sample of ten questionnaires from each of the 32 tests was made. Each Tanzanian scored the sample from 16 test cells. The investigator later scored the same tests and the remainder of the total sample using the scoring table and guidelines. A Pearson product moment correlation was calculated for the scores using half the number of responses scored by each of the Tanzanians (N = 160). It yielded $r_p = .92$ ($p < .001$), indicating a high agreement between the Tanzanian judges and the investigator.

The model answers (translated into English) for the various actions in the animation mode are as follows:

1. A man is driving a nail into a board with a hammer.

   2 + 2 + 2 + 2 + 2 = 10 points

2. A man is cutting a board with a saw.

   2 + 2 + 2 + 2 = 8 points

3a. A man is cultivating the garden with a jembe.

2 + 2 + 1 + 2 = 7 points

or, alternatively,

3b. A man is splitting a log with an axe.

2 + 2 + 1 + 2 = 7 points

4. A young man is riding a bicycle.

2 + 2 + 2 = 6 points

5. A man or woman is sweeping with a broom.

2 + 2 + 2 = 6 points

In the case of live action, the only changes were to expect greater precision in specifying the subject' age and to eliminate alternative 3b. This meant that numbers 2, 3a, and 5 required some form of "young male" as the response. Albernative 3b was deemed appropriate in scoring the animation since there was ambiguity in the rendering of the jembe. It could be construed as an axe, particularly in the long shot situation where the screen size for the tool was small. This ambiguity was not a problem in the live action mode. The hammer shots were used three times for a possible 30 points; the saw shots three times for 24 points; the sweeping twice for 12 points; and the bicycle and jembe shots were used once each for 6 and 7 points, respectively.

CHAPTER 4

Results and Discussion

Table 2 provides summary descriptive data for the overall distribution of scores on the filmic comprehension test. A single score was derived for each individual by adding results of the ten items. Figure 3 is the graphed frequency distribution for all scores.

TABLE 2

Descriptive Data for all Scores

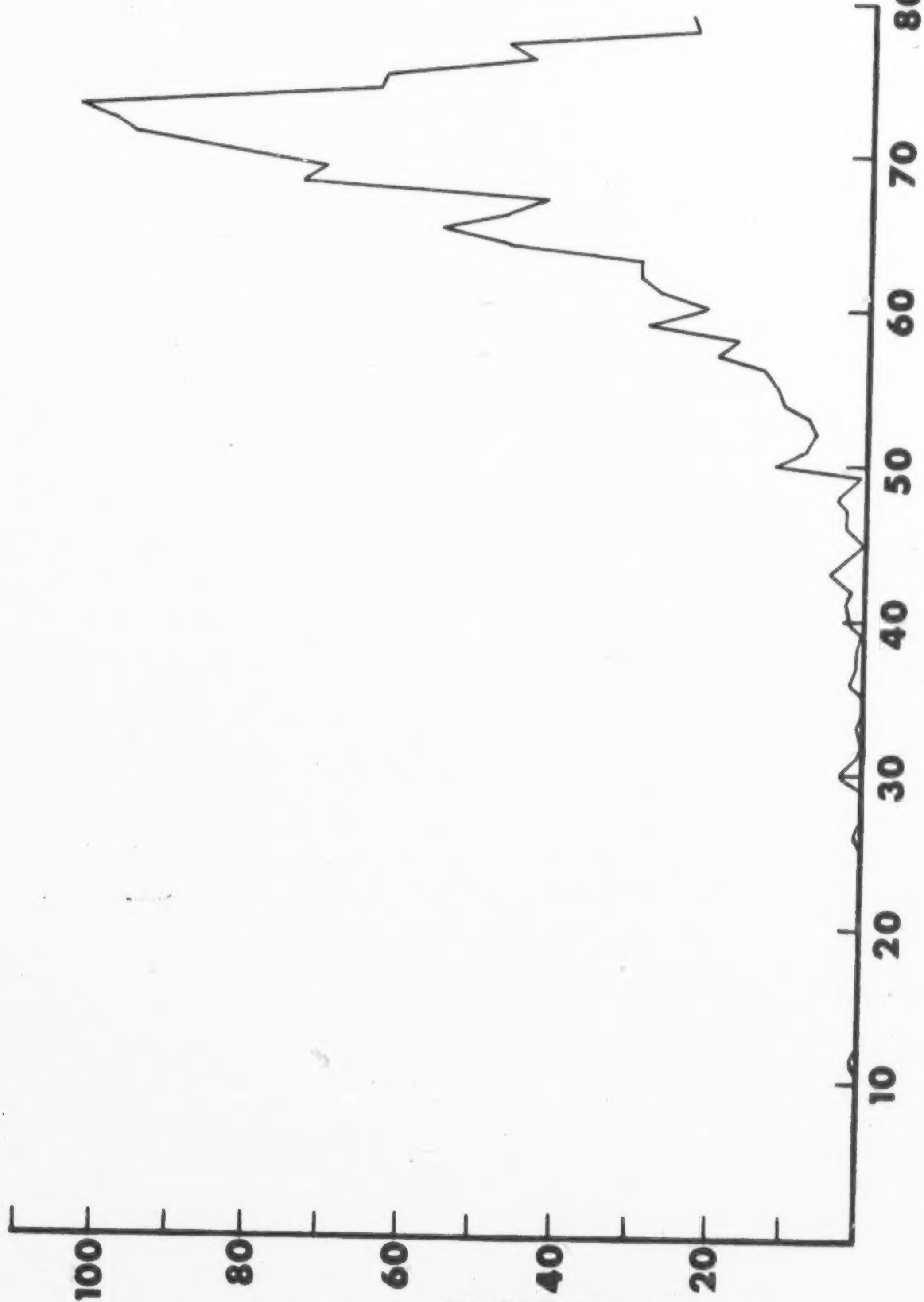
Total N	Mean	S.D.	Q_1	Median	Q_2	Mode	Range
1,267	67.70	8.02	64.7	70.17	73.6	73	12 - 79

The overall distribution is unimodal and negatively skewed with a moderately small standard deviation providing a sharp peak. The task was not difficult for most pupils, and the right end of the distribution curve is cut off because 24 or 2% of the total number achieved perfect scores of 79 points. If the task had been more difficult, the results would reflect a greater tendency toward normality since the standard deviation would increase and the right side of the curve would descend more typically toward the abscissa.

Analysis of Variance: 2^5 Factorial Design

Five treatments (chroma, background, camera mode, audio, and geography) of two factors each were subjected to an unweighted-means

Figure 3. Overall frequency distribution



analysis of variance (ANOVA). The unweighted-means approach was appropriate because cell sizes were unequal (range: 19 - 54 with a mean of 39.6 pupils per cell). The cell size inequality resulted from using intact groups and was unrelated to the experimental treatments. The unweighted-means solution rather than the least-squares solution is appropriate when unequal cell sizes are the result of non-treatment related conditions (Winer, 1962, p. 222). Further discussion of statistical issues is found in Appendix 7.

Table 3 presents the summary data of the 2^5 ANOVA.[1] Of the 31 possible effects, 9 were significant (.01 level of significance):

Main Effects:
- Background (B)
- Camera mode (C)
- Audio (E)

Two-Factor interaction:
- B x C

Three-Factor interactions:
- A x C x E
- B x C x E
- B x D x E
- C x D x E

Four-Factor interaction:
- A x B x C x D

Attention in this preliminary 2^5 ANOVA test is directed at the only non-filmic treatment, geography (D). Geography was not

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[1] The following abbreviations will be used to signify the various treatments and treatment factors:

Chroma (A) - CHR
  Black and white (a_1) - BW
  Color (a_2) - CO

Camera mode (C) - CAM
  Animation (c_1) - AN
  Live action (c_2) - LV

Audio (E) - AUD
  Silent (e_1) - SI
  Sound (e_2) - SD

Background (B) -BGD
  Plain (b_1) - PL
  Complex (b_2) - CX

Geography (D) - GEO
  Urban (d_1) - UR
  Rural (d_2) - RU

TABLE 3

2^5 Factorial Design Summary Table (ANOVA)

Source	DF	MS	*F*
Chroma (A)	1	125.78	2.62
Background (B)	1	2,422.37	50.52**
Camera Mode (C)	1	9,022.73	188.17**
Geography (D)	1	12.00	.25
Audio (E)	1	428.11	8.93*
AB	1	6.26	.13
AC	1	131.15	2.74
AD	1	7.06	.15
AE	1	57.97	1.21
BC	1	391.00	8.15*
BD	1	46.79	.98
BE	1	50.15	1.05
CD	1	60.45	.18
CE	1	196.53	5.18[a]
DE	1	248.32	.92
ABC	1	6.56	.14
ABD	1	8.57	.26
ABE	1	908.09	4.10[b]
BCD	1	.22	.00
BCE	1	422.91	8.82*
BDE	1	137.63	12.31**
CDE	1	590.28	19.05**

TABLE 3--Continued

Source	DF	MS	F
ACD	1	279.38	5.83[c]
ACE	1	44.30	18.94**
ADE	1	.21	.00
ABCD	1	3,540.65	73.84**
ABCE	1	.42	2.87[d]
ABDE	1	913.59	.01
ACDE	1	3.84	.08
BCDE	1	309.29	6.45[e]
ABCDE	1	173.09	3.61[f]
SS within	1235	47.95	

*p<.01 [a]p = .024 [c]p = .018 [e]p = .012

**p<.001 [b]p = .045 [d]p = .094 [f]p = .060

significant as a main effect (Tables 3 and 4), nor was geography involved in any significant two-factor interactions. Geography appears in two significant three-factor interactions and the single significant four-factor interaction. When geography's effects were combined with the audio effects, the presence of either of the other two significant main effects (background, camera mode) creates a significant interaction. Tables 5 and 6 give the means for the B x D x E and C x D x E interaction levels while Figures 4 to 9 are the graphs for the two interactions.

In Figure 5, the b_1 x E at d_2 line does not conform to the general slope of the other lines in the interaction. One reason for this deviation may be the confounding of geography with school effects

TABLE 4

H_5: Geography Treatment Data (D)

Level	N	$\overline{X}$	S.D.	s^2	s^2 ratio	*t*[a]
Urban (d_1)	715	67.81	8.28	68.6117	1.167	.559
Rural (d_2)	552	67.55	7.67	58.7992		

[a] The entry point into the *t* table is determined by the degrees of freedom (df) associated with a given *t* value. For a non-significant s^2 ratio, df = $n_1 + n_2 - 2$. For a ratio where s^2_1 and s^2_2 are significantly different, and $n_1 = n_2 = n$ (or approximately), df = n - 1 (Edwards, 1960, p. 108). For all practical purposes in using the *t* table, any two numbers greater than 100 can be counted as approximately equal. The practice adopted here was to enter the *t* table using the smallest of the two numbers.

TABLE 5

Summary of Means: B x D x E

GEO		UR (d_1)		RU (d_2)	
AUD		SI (e_1)	SD(e_2)	SI (e_1)	SD (e_2)
BGD	PL (b_1)	71.08	67.82	68.33	69.54
	CX (b_2)	66.85	65.38	66.91	65.37

TABLE 6

Summary of Means: C x D x E

GEO		UR (d_1)		RU (d_2)	
AUD		SI (e_1)	SD (e_2)	SI (e_1)	SD (e_2)
CAM	AN (c_1)	67.55	62.62	63.87	65.66
	LV (c_2)	70.46	70.77	71.04	69.47

Figures 4 - 6. Interaction plots for B x D x E (BGD x GEO x AUD)

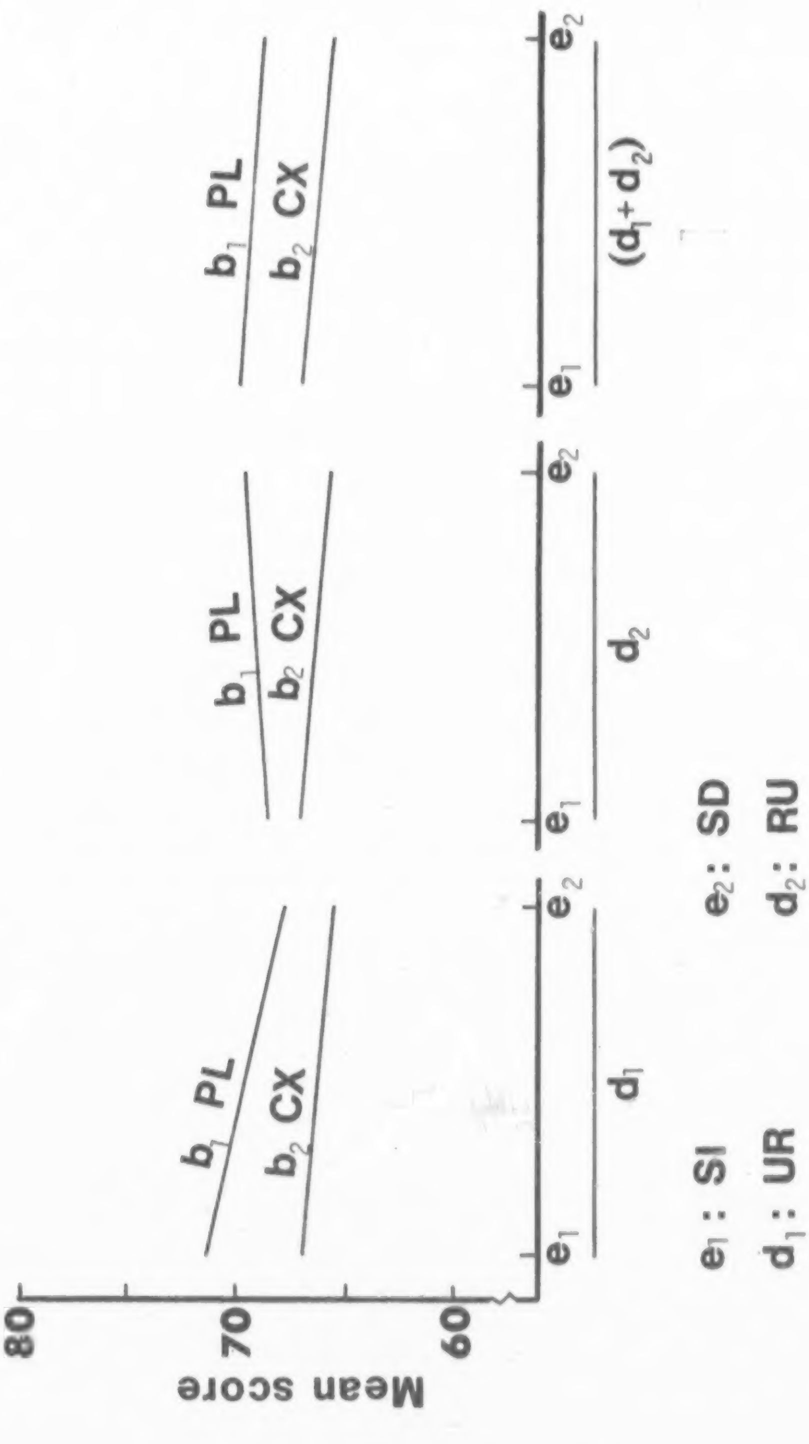

Figure 4. B x E at d_1

Figure 5. B x E at d_2

Figure 6. B x E at (d_1+d_2)

Figures 7 - 9. Interaction plots for C x D x E (CAM x GEO x AUD)

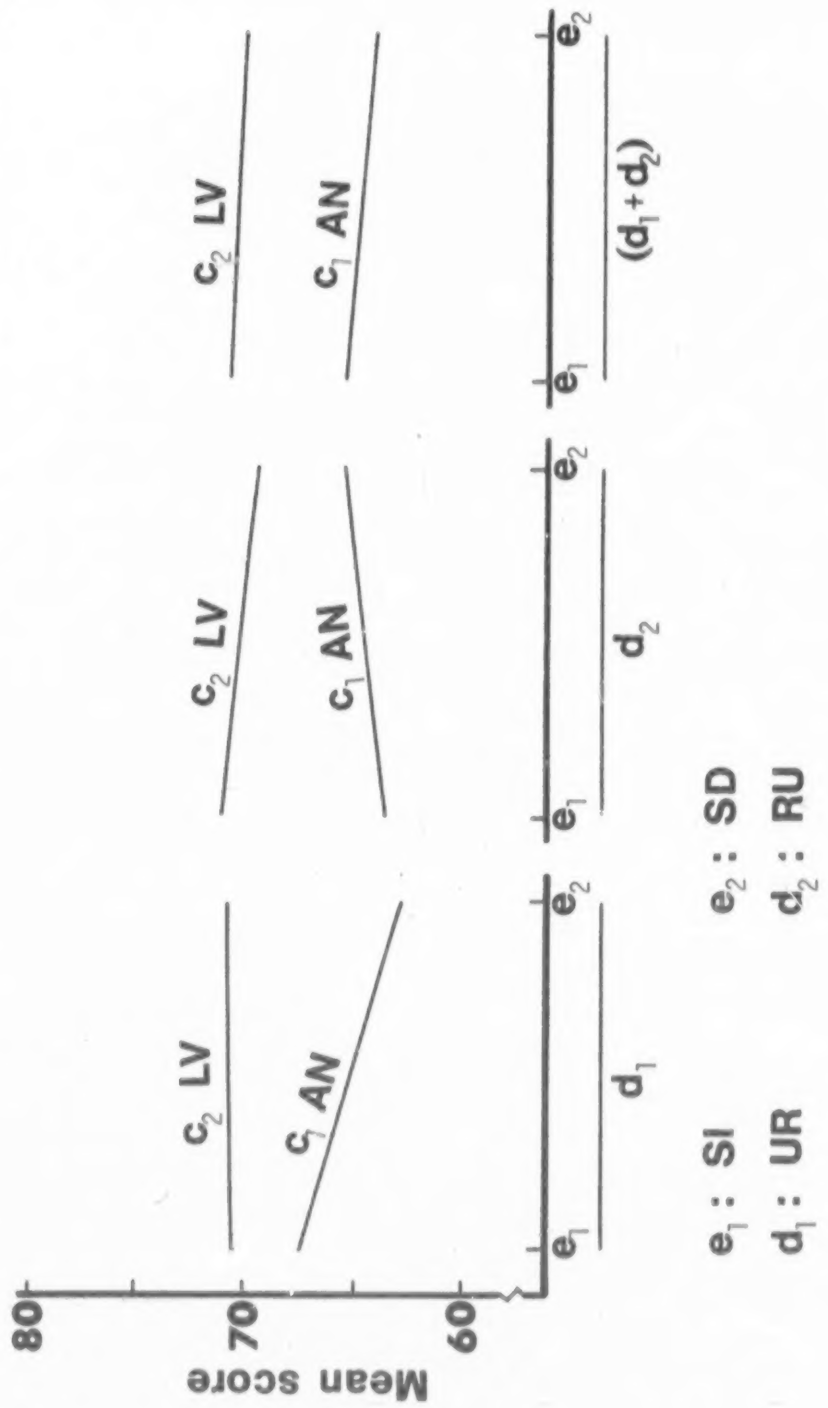

Figure 7. C x E at d_1

Figure 8. C x E at d_2

Figure 9. C x E at (d_1+d_2)

from two Standard 6 cells (Madunga and Mjimwema) at the e_1 point. The e_2 point has only one Standard 6 cell (Vikindu) in addition to the highest scoring cell (Mikese). Findings reported later in this chapter indicate that level of education is related to filmic comprehension. It does not appear that the geographic variable produced a systematic effect resulting in the significant interaction B x D x E. Averaged across $d_1 + d_2$ (Figure 6), the B x E lines appear parallel and the B x E F ratio in Table 3 confirms a nonsignificant interaction. The same is true for B x D.

Analysis of three-factor interactions is complex enough under ideal conditions of full random assignment of all subjects to treatments. The difficulties in analyzing the B x D x E interaction convinced the investigator that reporting the detailed analysis of the C x D x E interaction would not be particularly useful given the chance groupings of intact groups. The interaction means are reported in Table 6 and graphed in Figures 7, 8 and 9. When the interaction was scrutinized closely, the possibility emerged that three kinds of geographic groupings might exist within the sample rather than the anticipated two (urban and rural). The rural sample appeared to be divided into schools which were isolated and those with comparatively easy access to towns. This lead is pursued in some depth later and does not directly bear upon the discussion of three-factor interactions affecting the non-significant main effects of geography.

No attempt was made to interpret the significant four-factor interaction A x B x C x D since the number of ways of interpreting the results is high and the outcome possibly meaningless even under the best of circumstances (Edwards, 1960, p. 197).

To summarize: There was no significant geography effect nor any meaningful interactions of geography with filmic treatments. This finding permitted collapsing the design to a simpler 2^4 factorial which included only the four filmic treatments. The geography hypotheses could not be easily dismissed, however, and there were certain indications from analysis of the higher order interactions that some complexity might exist within the geographic groupings. The geographic hypothesis is pursued following discussion of the filmic hypotheses.

Filmic Hypotheses

The analytic procedure used for testing the filmic hypotheses was to calculate an analysis of covariance with the uncontrolled population variables of age, viewing experience, town experience, and education as covariates (Table 7, following page).[2]

H_1: Chroma (Black and white vs. color). Table 8 summarizes the data for color and black-white levels of the chroma factor. From Table 7, the chroma main effect F ratio is not significant.

TABLE 8

H_1: Chroma Data (A)

Level	N	$\overline{X}$	S.D.	s^2	s^2 ratio	t
Black and white (a_1)	660	67.42	8.20	67.2363	1.10	1.287
Color (a_2)	607	68.00	7.81	61.0429		

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[2] Comparison of the ANOCOVA with an ANOVA (unweighted means) and an ANOVA (least squares) is found by referring to Tables 32 and 33 in Appendix 7.

TABLE 7

2^4 ANOCOVA Summary Table

Least Squares Solution with 4 Covariates

Source	DF	MS	F
Chroma (A)	1	-1.	-.01
Background (B)	1	2,284.	44.35**
Camera Mode (C)	1	7,422.	144.11**
Audio (E)	1	308.	5.98[a]
AB	1	13.	.25
AC	1	106.	2.06
AE	1	193.	3.75[b]
BC	1	544.	10.56*
BE	1	3.	.06
CE	1	99.	1.92
ABC	1	114.	2.21
ABE	1	156.	3.02[c]
ACE	1	848.	16.46**
BCE	1	253.	4.91[d]
ABCE	1	-3.	-.06
Age	1	262.	5.09[e]
Town Experience	1	32.	.62
Viewing Experience	1	302.	5.86[f]
Education	1	616.	11.96**
SS Within	1248	51.50	

*$p < .01$

**$p < .001$

[a] $p = .016$

[b] $p = .054$

[c] $p = .087$

[d] $p = .028$

[e] $p = .025$

[f] $p = .017$

The chroma factor is part of one significant three-factor interaction A x C x E. Table 9 is a summary of means for this interaction. The interaction is graphed in Figures 10-12.

TABLE 9

Summary of Means: A x C x E

CHR		BW (a_1)		CO (a_2)	
AUD		SI (e_1)	SD (e_2)	SI (e_1)	SD (e_2)
CAM	AN (c_1)	64.44	64.41	67.81	63.44
	LV (c_2)	71.24	69.40	70.09	70.99

The interaction lines indicate that c_1 x E at a_2 (color animation with respect to audio) was the most disparate treatment combination with a difference of 4.37 points between the silent and sound treatment levels (silent superior). The corresponding black and white animation audio combination, c_1 x E at a_2, has a difference of only .03 points. In this instance, color appears to sharpen the difference between animation silent and animation sound in favor of the former. This significant interaction finding is not conclusive enough to indicate that the hypotheses involving chroma (H_1), camera mode (H_2), and audio (H_4) should be rejected or even put under stringent conditions related to the interaction findings.

After a preliminary graphing of the perceptual hierarchy (Figure **16**, Chapter 5) using the mean scores from the 16 cells in the 2^4 factorial, it was pointed out to the investigator that the color mean scores exceeded the black and white mean scores in 6 out of the 8 cell comparisons. Two of these 6 comparisons were statistically significant. While the 6/8 proportion is within a chance

Figures 10 - 12. Interaction plots for A x C x E (CHR x CAM x AUD)

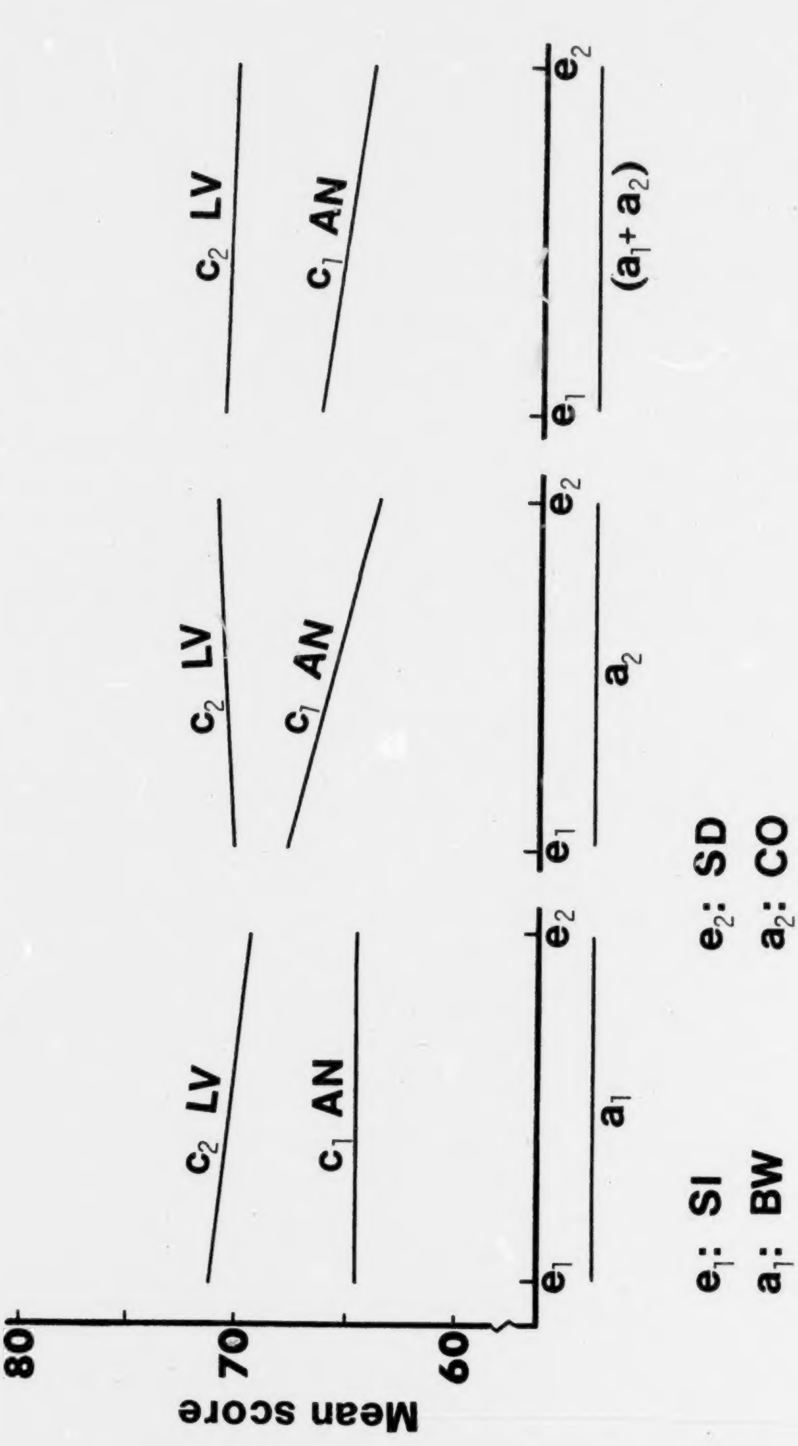


Figure 10. C x E at a_1

Figure 11. C x E at a_2

Figure 12. C x E at (a_1+a_2)

finding and does not affect the decision on H_1, it does indicate the complexity of the chroma-achromatic issue and the need for additional, more sophisticated research.

The data indicate that the hypothesis stating that the effect of color in this study is not different from black and white cannot be rejected. In other words, color does not enhance comprehension, except possibly in interaction with audio and camera mode.

H_2: Camera Mode (Animation vs. live action). Table 10 summarizes essential data for the camera mode factor. The highest mean squares in the ANOCOVA, Table 7, are found under the camera mode factor. Camera mode appears in two significant interactions, B x C and A x C x E. A summary of means for B x C appears in Table 11 while the A x C x E interaction means appear in Table 9.

TABLE 10

H_2: Camera Mode Data (C)

Level		$\overline{X}$	S.D.	s^2	s^2 ratio	t
Animation (c_1)	632	64.92	8.56	73.2122	1.82*	13.090**
Live Action (c_2)	635	70.46	6.34	40.1828		

*$p < .01$

**$p < .001$

TABLE 11

Summary of Means: B x C

BGD		PL (b_1)	CX (b_2)
CAM	AN (c_1)	67.04	62.90
	LV (c_2)	71.41	69.50

From the graphed interaction B x C (Figure 13) it is clear that animation and live action were related to the type of background, plain and complex. The complex background factor (b_2) lowered the two camera mode factors, particularly the animation mode. It can be surmised that the camera mode main effect was not dependent upon the background treatment for the difference between animation and live action. This difference was enhanced by the type of background, however.

The conclusion from the camera mode data including the interaction with other factors is that the null hypothesis stating that animation and live action treatments are equal should be rejected. The findings indicate that live action was superior to animation. The difference was increased when the background was complex.

$\underline{H_3}$: Background (Plain vs. complex). Table 12 summarizes the findings for the background treatment. ANOCOVA data from Table 7 indicate a significant difference for the background treatment. Table 11 and Figure 13 refer to the significant B x C interaction previously introduced with the discussion of the camera mode factor.

TABLE 12

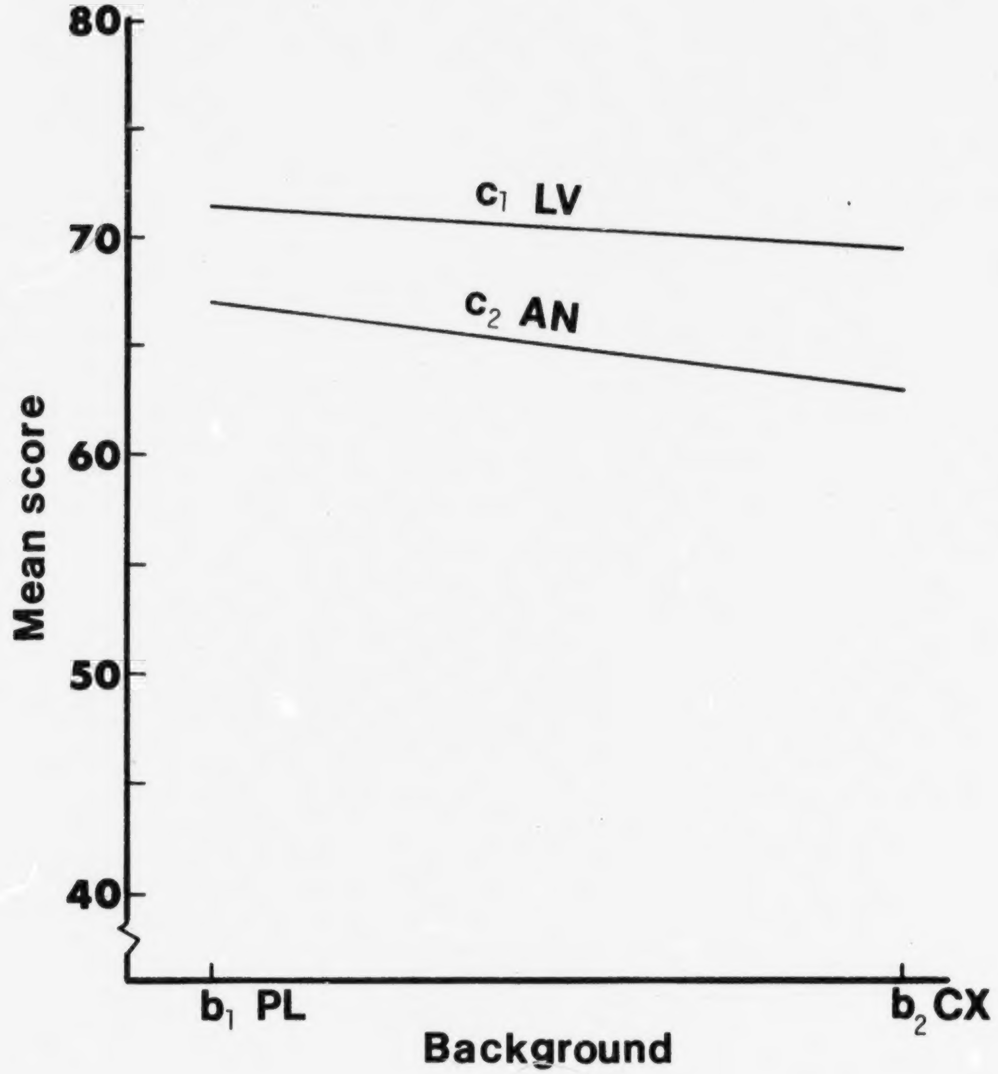
H_3: Background Data (B)

Level	N	$\overline{X}$	S.D.	s^2	s^2 ratio	t
Plain (b_1)	628	69.27	7.35	53.9929	1.29*	7.064**
Complex (b_2)	639	66.15	8.35	69.7163		

$^*p < .01$

$^{**}p < .001$

Figure 13. Interaction plot for B x C (BGD x CAM)



B x C was the only significant interaction for the background factor. Previous discussion of B x C concluded that the type of background caused a shift in comprehension of the two camera modes. Strictly speaking, this cause and effect statement can be turned around to suggest that the kind of camera mode changed the finding for the background effect.

In the actual dynamics of the experimental task, the information required to complete the task was conveyed by the camera mode independent of the background. The significant B x C interaction indicates that the degree of background complexity was related to the camera mode. The complex background inhibited comprehension of the animation more than it did the live action. Apparently, the figures were buried in the background which distracted the pupils from the main figure's actions.

From the data, the null hypothesis stating an equal effect for plain and complex backgrounds should be rejected. The alternative hypothesis stating that filmic comprehension is higher with the use of plain backgrounds is accepted.

$\underline{H_4}$: Audio (Silent vs. sound). Data for the final filmic variable tested in this study are found in Table 13. Additional data

TABLE 13

H_4: Audio Data (E)

Level	N	$\overline{X}$	S.D.	s^2	s^2 ratio	t
Silent (e_1)	638	68.37	7.82	61.1530	1.09	3.008*
Sound (e_2)	629	67.02	8.17	66.6796		

*$p < .01$

are contained in the ANOCOVA, Table 7. The only significant interaction involving the audio factor is the A x C x E interaction (Table 9 and Figures 10-12), discussed previously.

Evaluation of the audio treatment main effect is made interesting by the change from a highly significant mean square ($p<.001$) in the ANOVA (Table 32 in Appendix 7) to an ANOCOVA mean square just missing the selected significance level ($p = .016$). Inspection of the cell data indicates that part of this reduction occurred because there were a disproportionate number of Standard 6 pupils receiving the sound treatment as compared to the silent treatment. The ANOCOVA's control for this factor reduced the audio mean square. Interpretation of these findings can be made in three different ways:

1. Where there is a heterogeneous audience of Standard 6 and Standard 7 pupils, the overall effect of the audio factor is for the silent version to be superior to the same version with sound effects. The null hypothesis is rejected and the alternative hypothesis that the silent version is superior is accepted.

2. Where the audience is homogeneous with a Standard 7 education, the null hypothesis is not rejected and the conclusion is made that the silent and sound versions exhibit equal effects when employed under conditions of the study.

3. Since the findings are mixed, the best course of action is to avoid making a decision until further evidence is found which either accepts or rejects the null hypothesis. In the meantime, the results are reported and interpretation is left with the reader.

In familiar terms, the use of sound effects did not help filmic comprehension and in fact may have hindered comprehension since many of the pupils did better without the sound effects. Perhaps the sound effects acted in the same way as the complex background --inhibiting the focusing of attention on the main figures' activities on the screen.

Because this study is intended to serve the interests of two groups, filmmakers and film scholars, two interpretations are necessary. For the filmmaker who must choose between using a silent or sound treatment for a film intended for the study's population of school children, the investigator believes that choice of alternative one above (rejecting the null hypothesis) is appropriate, since the strong indication is that the use of sound effects does not assist in filmic comprehension. For the film scholar, the third alternative of suspending a definite interpretation until more evidence is in seems the safer and more scientific path to follow, despite the findings of the ANOCOVA which would technically support not rejecting the null hypothesis. Complicating interpretation is the unknown precision of the ANOCOVA's control of the education covariate. This need for caution is discussed further in Appendix 7.

Population Hypotheses

H_5: Geography (Rural vs. urban). This hypothesis is concerned with rural and urban dwelling school children and was partially discussed earlier in this chapter. The data from the 2^5 ANOVA (Table 3) and the summary data in Table 4 indicated that there was no significant difference between pupils attending rural schools and those attending urban schools. Disparate results for rural isolated schools in the C x D x E interaction pointed toward a more complex situation.

Data were collected during the testing to closely examine the geography hypothesis. The pupils in rural schools were asked to indicate their past residence in towns. Prior research indicates that urban/rural living may be a factor in visual perception and, by implication, filmic comprehension.

Table 14 displays the findings for the town experience data.

TABLE 14

H_5: Town Experience Data

Combination	N	$\overline{X}$	S.D.	s^2
1. Rural w/o town	407	66.80	7.98	63.6800
2. Rural w/ town	145	69.68	6.27	39.2598
3. Urban	715	67.81	8.28	68.6117
4. Urban + rural w/ town	860	68.12	8.01	64.1038

Table 15 presents various t tests for comparing town experience combinations.

TABLE 15

H_5: Town Experience - t tests

	s^2 ratio				t			
Combination	1	2	3	4	1	2	3	4
1. Rural w/o town	-	1.62*	1.08	1.01	-	4.406**	1.994[a]	2.761*
2. Rural w/ town	-	-	1.75*	b	-	-	3.088*	b
3. Urban	-	-	-	b	-	-	-	b
4. Urban + rural w/ town	-	-	-	-	-	-	-	-

*$p < .01$ [a] $p = .048$

**$p < .001$ [b] Not applicable because means are not independent.

In the ANOCOVA, the town experience covariate used the first three combinations in Table 14 for the town effect. The F ratio on that analysis was .62. A very small point biserial correlation was obtained (r_{pb} = .08) between the town vs. no-town scores. The correlation was raised somewhat by comparing only the rural pupils using the town and no-town scores (r_{pb} = .17, $p<.01$), but this remains too low to claim any predictive relationship between town experience and filmic comprehension. The small group of rural pupils with town experience exhibited a significantly higher mean score and lower variance than both their rural colleagues without town experience and the urban pupils. The lower variance may result from a lower number of pupils in the rural w/ town category. This finding led to greater scrutiny for the rural w/ town group of pupils.

Almost all of the rural w/town pupils were in four of the eight rural schools (138 out of 145). Three of these schools (Mikese, Mjimwema, and Vikindu) were classified as rural with access to a town. The fourth (Usangi) is a girls boarding and day school drawing upon girls from both rural and urban areas despite its isolated location. Vikindu Primary School is a boys boarding and day school. Because the first three schools above had Standard 6 pupils in the testing, there was a ratio of Standard 6 to Standard 7 pupils of 67 to 78. The overall sample had 353 Standard 6 pupils to 914 Standard 7 pupils. The sex ratio of 104 males to 41 females is higher than the total sample proportion which was 827 males to 440 females.

The superior film comprehension exhibited by the rural w/ town pupils may or may not be a function of their having lived in a town. It may, instead, be a result of some factor of the schools they now attend. To control for this school factor, comparison of population variables was made within the four types of schools cited above. This categorizing provided four independent groups to compare on the rural urban variable; rural w/o town, urban, and two groups from the same schools, rural w/o town and rural w/ town. Tables 16 and 17

TABLE 16

H_5: Town Data by School Category

School Category	N	$\overline{X}$	S.D.	s^2
1. Rural w/o town[a]	275	64.71	8.15	66.4859
2. Rural w/ town	277	70.38	5.94	35.2661
2a. Pupils w/o town	140	70.79	5.76	33.2014
2b. Pupils w/ town	137	69.96	6.11	37.2854
3. Urban	715	67.81	8.28	68.6117

[a] This category contains 7 pupils w/ town experience.

summarize the town experience vs. score data by school categories. The findings in these tables are intriguing. The only non-significant difference was between pupils without town experience and those with town experience from the rural school w/ town category. All other *t* tests were significant at the .001 level and beyond. There were differences in variance as well as mean data. The amount of variance separated the rural w/ town category of schools from the other two geographic groups. A point biserial correlation between rural w/o town schools and rural w/ town schools was moderately low ($r_{pb} = .37$, $p<.01$), but more than double the previous correlation using rural town/no-town data. The correlation indicates the relationship between

TABLE 17

H_5: Town Data by School Category - t tests

School Category	s^2					t test				
	1	2	2a	2b	3	1	2	2a	2b	3
1. Rural w/o town	-	1.88*	2.00*	1.78*	1.03	-	9.346**	8.797**	7.335**	5.302**
2. Rural w/ town	-	-	a	a	1.94*	-	-	a	a	5.450**
2a. Pupils w/o town	-	-	-	1.12	2.06*	-	-	-	1.162	5.172**
2b. Pupils w/ town	-	-	-	-	1.84*	-	-	-	-	3.553**
3. Urban	-	-	-	-	-	-	-	-	-	-

*$p < .01$

**$p < .001$

[a] Not applicable

the type of rural school and score on the filmic comprehension test.

Does school quality account for the differences in mean scores reported in this section? A high percentage of category two pupils (rural w/ town) in Table 15 were enrolled in two of three boarding schools tested, although day pupils were mixed with them. One possible interpretation is that the study used a language-based test to arrive at a measure of filmic comprehension. Language aptitude might be better in schools at least partially composed of pupils seeking a higher quality education and whose parents (perhaps themselves educated) can afford the higher fees entailed with boarding school education. A few male pupils at the Vikindu Primary School, for instance, commute the 14 miles from Dar es Salaam to the school. The fact that people sought out a rural school when urban schools were nearer indicates a feeling that there are differences in school quality.

Too much emphasis can be placed on school quality--especially since the point biserial correlation is not especially large for the most divergent school categories. The study did not control for language aptitude beyond reliance on the use of commonly found physical actions and their linguistic descriptions. A regional pattern can be seen in the data of Table 18 which might strengthen the interpretation of language facility contributing to higher filmic comprehension scores. The argument would be that there is more facility with Swahili in Morogoro and Coast Regions than in Arusha and Kilimanjaro Regions. However, the correlation between score and region ($r_p = .15$, $p<.001$) is too low to justify making any prediction based on the regional origin of a pupil. Thus no firm conclusion can be stated about the link between the pupils' language aptitude and the language measure of filmic comprehension.

TABLE 18

H_5: Regional Data

Region	N	$\overline{X}$	S.D.	s^2
1. Arusha	280	65.50	8.24	67.9713
2. Kilimanjaro	278	67.39	8.01	64.1526
3. Morogoro	321	68.48	7.17	51.3377
4. Coast	388	68.86	8.22	67.5864

TABLE 19

H_5: Regional Data - t tests

	s^2 ratio				t tests			
Region	1	2	3	4	1	2	3	4
1. Arusha	-	1.06	1.32*	1.00	-	2.746*	4.696**	5.206**
2. Kilimanjaro	-	-	1.25*	1.06	-	-	1.744^a	2.300^b
3. Morogoro	-	-	-	1.32*	-	-	-	.657
4. Coast	-	-	-	-	-	-	-	-

$*p<.01$ $\quad {}^a p = .084$

$**p<.001$ $\quad {}^b p = .025$

The original intention was to have equal numbers of pupils from each region to balance the design on a regional basis. The balance was upset by administrative difficulties in the field, which accounts for the greater number of Coast Region pupils. The overall results slightly favored the Coast. The only significant differences arose between Arusha Region and the rest of the regions. However, Arusha Region was balanced in the design, as described in the previous chapter. Thus any depressing effect by Arusha Region scores would be equalized through the design. Any distortion in the overall results because of the increased representation of the Coast Region pupils would be to increase the scores rather than depress them. A potentially troublesome observation of a different sort does arise from scrutiny of Table 18. While not directly related to the geography hypothesis, it is appropriate to briefly digress to discuss the ascending scores which match perfectly with the order of testing.

A Spearman rank-order correlation was calculated using the order of test presentation using regional identification compared with mean score for the pupils. The result ($r_s = .34$, $p = .056$) indicated a weak relationship, but the significance test cautions that this relationship could be a chance finding. It was concluded that the scores by region were not strongly related to the order of test administration, if at all.

The confusion regarding geography and filmic comprehension is not entirely resolved. The findings indicate that a group of quite varied rural schools did not differ from urban schools in filmic comprehension. Schools in rural areas with a substantial (approaching 50%) number of pupils who have lived in a town for over a year differed significantly from both urban schools and those rural schools without the town-experienced pupils. The contributions of language facility, quality of teaching, prior viewing experience, and age are possible reasons for this filmic comprehension differential as a function of town-experienced pupils. This study can only speculate on the matter of language facility and teacher quality. Data gathered about viewing experience and age are analyzed later in the chapter. Another possible relationship between filmic comprehension and a population variable is the sex of the viewer. The findings from this hypothesis follow.

$\underline{H_6}$: Sex. Table 20 summarizes the data for the male and female pupils. A zero point biserial correlation ($r_{pb} = .04$) indicates there is no predictive relationship for filmic comprehension based on a pupil's gender. Sex was not included as a covariate because the data represented in Table 20 indicated that it bore no relation to filmic comprehension.

TABLE 20

H_6: Sex Data

	N	$\overline{X}$	S.D.	s^2	s^2 ratio	$\underline{t}$
Males	827	67.91	7.64	58.3449	1.29*	1.261
Females	440	67.29	8.68	75.4049		

*$p < .01$

The data clearly do not permit rejection of the null hypothesis. There was no difference in overall filmic comprehension between male and female pupils. While the mean scores were nearly identical, there was greater variance among females than males. This finding led to more probing of the relationship between sex and the population variables of age, geographic residence, and education. Table 21 summarizes these findings. In interpreting these data, the reader should recall that 6 of the 32 classes (cells) tested were either in boys boarding schools or were nearly all male while 1 class of the 32 used in the data analysis was entirely female. One class of females was not used because of test administration difficulties discussed in Chapter 3.

TABLE 21

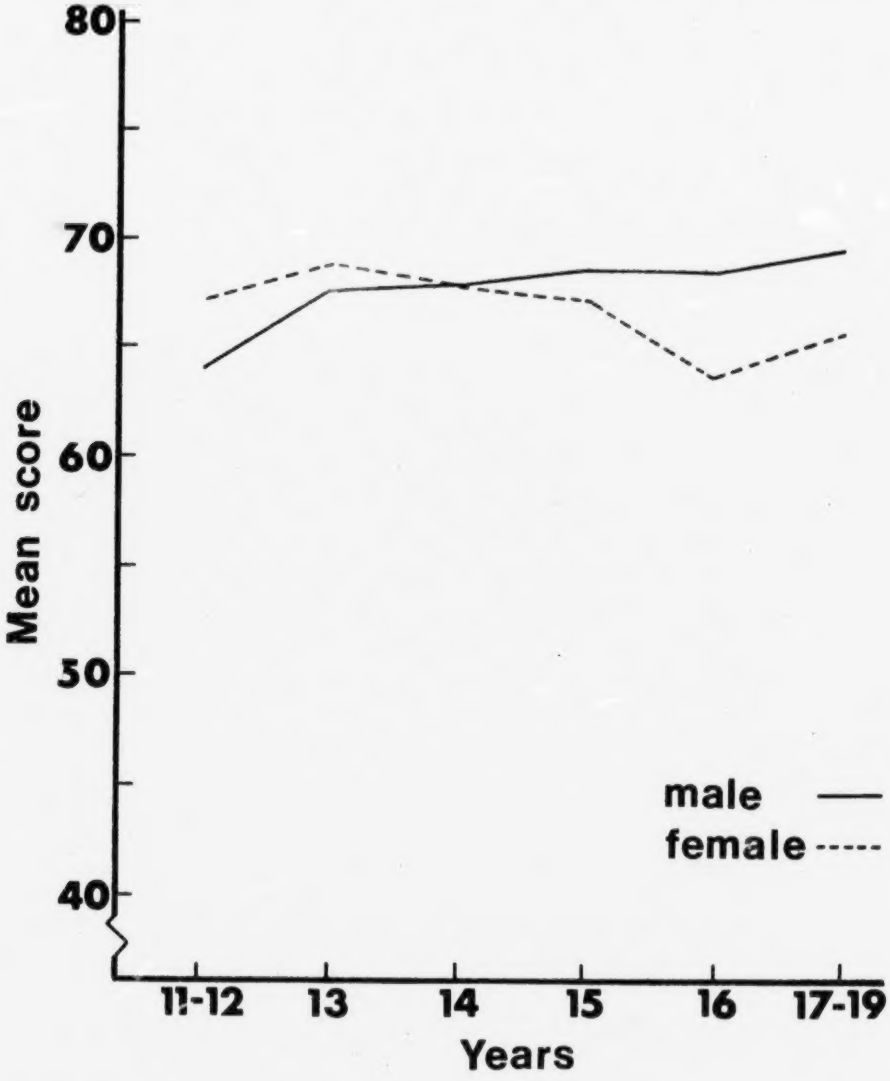
H_6: Sex Data for Three Subject Characteristics

Characteristic	Male				Female			
Age (Years)	N	%	$\overline{X}$	S.D.	N	%	$\overline{X}$	S.D.
11-12	64	7	63.95	9.53	68	15	66.96	7.64
13	127	15	67.23	8.21	128	29	68.47	8.30
14	167	20	67.78	7.28	119	27	67.78	9.28
15	160	19	68.38	8.59	64	15	67.02	8.71
16	137	17	68.11	6.40	34	8	63.59	10.13
17-19	172	22	69.43	6.12	27	6	65.70	8.67
Geography[a]								
Rural: w/o town pupils	198	24	65.65	7.59	77	18	62.29	9.06
Rural: w/ town pupils	187	23	70.18	6.18	90	23	70.80	5.42
Urban	442	53	67.97	7.93	273	62	67.55	8.83
Education								
Standard 6	219	26	66.53	7.80	134	30	63.40	8.60
Standard 7	608	74	68.41	7.52	306	70	68.99	8.17

[a] Pupil Town-Experience: Schools Category

The age/sex findings for filmic comprehension indicate there was superiority for the females until age 14 where the means are equal, and then male superiority through the older years. The graph in Figure 14 illustrates this clearly. The female pupils were generally

Figure 14. Mean score vs. age for males and females



younger; 61% were 14 years or younger vs. 42% for the males. The variances generally corresponded with the mean score trends for both males and females.

The geography/sex findings reinforce the conclusion of lack of difference between the sexes in filmic comprehension with one exception: Females in rural schools with no town-experienced pupils were less successful on the test than their male counterparts. This isolated male superiority finding may result from greater Swahili language facility among males and consequently in higher scores on the film tests. While both sexes are exposed equally to Swahili throughout their school experience, where Swahili is a second language there is probably more emphasis on facility in its use among males. Research currently being conducted in Tanzania on Swahili usage may prove or disprove this linguistic interpretation.

The findings for the education factor indicate that the Standard 7 pupils were not significantly different on the basis of sex, although the females were slightly superior. Females in Standard 6 classes did significantly less well than the Standard 6 males ($\underline{t}$ = 3.455, $p < .001$). The differences between Standards 6 and 7 were in favor of the Standard 7 pupils for both males and females. It was expected that the greater maturity and facility with Swahili of Standard 7 pupils should provide an edge over their younger Standard 6 colleagues in a novel testing situation. The lack of difference between males and females in Standard 7 was expected, but the difference between the sexes for Standard 6 was not anticipated. In fact the opposite might be expected from knowing that the younger females had higher average scores than younger males (Figure 14). It is concluded that this particular sex difference cannot be explained with the available data and that further data would be required for a sound explanation of why the Standard 6 females in the study's sample would have lower scores than Standard 6 males.

The exceptions discussed above do not alter the general conclusion that the male and female pupils included in the study did not differ in filmic comprehension. Evidence indicates that certain groups of female pupils (i.e., older female pupils and Standard 6 female pupils) do not have the same filmic comprehension level as their male counterparts or as their sisters and brothers in other groups. Empirical data to indicate the cause of these differences is not available from this study.

$\underline{H_7}$: Age. In contrast to the situation in American schools, there is a wide range of ages in the Tanzanian primary schools--particularly in Standard 7 where pupils may repeat a year in order to sit for the primary leaving examination a second or even third time. Table 22 presents the filmic comprehension results based on age. Figure 15 is a graphic presentation of mean score vs. age. For purposes of evaluating the null hypothesis, three age groups were established to reflect the lower, middle, and upper age brackets. The 11 and 12 year olds were pooled to form the lower group; the 13-16 year olds form the middle level group; the 17-19 year olds were merged to form the upper level age group. These three groups were created using natural dividing points suggested by the similar slopes of the mean scores between ages 12 and 13 and ages 16 and 17 (Figure 15). The ages 13-16 exhibit a plateau between these slopes and contain the bulk of the pupils.

Figure 15. Mean score vs. age

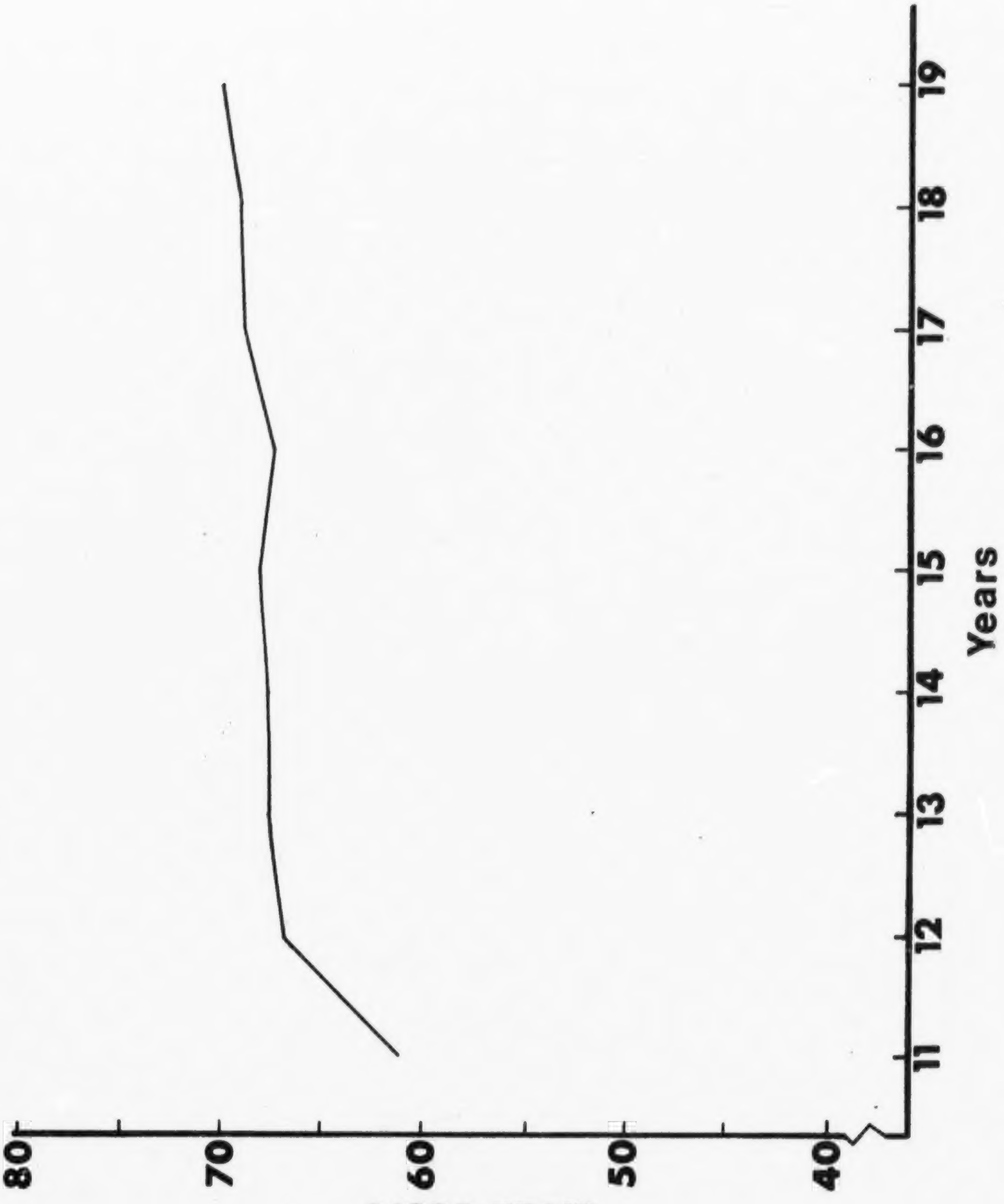


TABLE 22

H_7: Age Data

	Individual Years				Grouped Years			
Years	N	$\overline{X}$	S.D.	s^2	N	$\overline{X}$	S.D.	s^2
11	23	61.00	10.71	114.6364	132	65.50	8.47	71.3511
12	109	66.45	7.61	57.9720				
13	255	67.85	8.26	68.3084	936	67.75	8.17	66.7754
14	286	67.78	8.15	66.4932				
15	224	67.99	8.62	74.2600				
16	171	67.21	7.48	55.9319				
17	102	68.67	6.79	46.0462	199	68.92	6.62	43.8680
18	70	68.90	6.47	41.8015				
19	27	69.96	6.55	42.8832				

The null hypothesis is evaluated by a series of _t_ tests, Table 23. Other results assist in the decision-making process. Age

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TABLE 23

H_7: Age Data - _t_ tests

Age Group (Years)	s^2 ratio			_t_ test		
	1	2	3	1	2	3
1. 11-12	-	1.07	1.63*	-	2.945*	3.920**
2. 13-16	-	-	1.52*	-	-	2.166[a]
3. 17-19	-	-	-	-	-	-

$*p < .01$ $\quad$ $^a p = .034$

$**p < .001$

level (based on the year given by the respondents) was a covariate (Table 7) and yielded a nearly significant F ratio ($F = 5.09$, $p = .025$). However, the Pearson product-moment correlation between ungrouped age and score was near zero ($r_p = .08$), indicating that age was not related to filmic comprehension score in any predictable way.

The difference between the youngest and oldest groups of pupils was strongly significant. There was a lesser significant difference between the youngest and the middle group. The difference between the middle and oldest groups was in the significance reporting region of the study but failed to be statistically significant. There was not a statistical difference when only two groups were compared, 11-14 and 15-19 years (Table 24).

TABLE 24

H_7: Age Data - Upper and Lower Groups

Age Group (Years)	N	$\overline{X}$	S.D.	s^2	s^2 ratio	t
1. 11-14	673	67.36	8.29	68.7757	1.16	1.592
2. 15-19	594	68.08	7.69	59.0679		

Based on only the findings using three grouped age levels, the null hypothesis which states that the age groups do not differ in filmic comprehension would be rejected. The supplementary data must be considered in stating this conclusion, however. A two level age comparison was not significant; a correlation coefficient indicated virtually zero predictive power and the overall F test for the age covariate was not statistically significant.

The tendency for an increase in filmic comprehension with an increase in age held for males but not for females (Table 21) Several other population variables reflected the general finding of higher filmic comprehension levels for higher age levels. Table 25 summarizes the filmic comprehension data for geographic and education groups with respect to age.

TABLE 25

H_7: Age Data - Geography and Education

	Age Groups[a]								
	Group 1			Group 2			Group 3		
Geography[b]	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.
Rural: w/o town pupils	9	62.44	7.54	203	64.11	8.44	63	66.86	6.93
Rural: w/ town pupils	26	67.77	7.16	182	70.74	5.32	69	70.43	6.79
Urban	97	65.18	8.77	551	68.09	8.38	67	69.31	5.69
Education									
Standard 6	65	63.71	7.74	248	65.44	8.40	40	67.43	7.71
Standard 7	67	67.24	8.80	688	68.58	7.93	159	69.30	6.29

[a] Group 1: 11-12 years
Group 2: 13-16 years
Group 3: 17-19 years

[b] Pupil Town-Experience: Schools Category

Table 25 can be scanned for inter-age information by row and intra-age information by column. Caution should be used in comparisons with Group 1, rural w/o town combination, since the total number was only nine pupils. This low number is an interesting fact in itself and a comment upon the higher ages found in those schools compared to the rural schools with a high number of pupils with town experience.

The findings of the education part of Table 25 indicate that education apparently dominated age as a factor in achieving higher filmic comprehension scores. The t test comparisons are reported in Table 26 and contain only one significant difference between the two education groups for each age level. However, each of the Standard 7 age levels was higher than the corresponding Standard 6 age level for the mean scores. Since the original plan for the study did not consider an education comparison, these data are limited and should not be considered definitive because of the unequal numbers between groups.

TABLE 26

H_7: Age and Education - t tests

Age Level (years)	Standard 6 s^2	Standard 7 s^2	s^2 ratio	t test
1. 11-12	59.8351	77.3664	1.29*	2.45[a]
2. 13-16	70.5788	62.8851	1.14	5.270**
3. 17-19	59.4301	39.5918	1.50*	1.425

$*p<.01$ $^a p = .015$

$**p<.001$

The overall results for H_7: Age reveal an increase in filmic comprehension with age increase. The null hypothesis is rejected on the basis of three grouped age levels. Results of comparisons with the population variables of geography and education maintain the finding of increasing filmic comprehension with age increases. However, the predictive power of age for individual filmic comprehension is very low. It appears that the test of basic filmic comprehension was given to a sample whose perceptual development was nearly uniform across all but the extreme ages of the pupils.

$\underline{H_8}$: Viewing Experience. The last population variable to be evaluated is somewhat different than the other three. Sex and age are variables beyond the control of the pupils. Geographic location is generally a family decision, and, for all intents and purposes, not within the control of the pupils. Film viewing is a function of two factors more within the direct control of the subjects: availability of a cinema performance and the personal decision to attend if available. In the case of urban subjects, availability varies from the commercial cinemas which feature American, European, and Indian films for a fee of 3 to 7.50 shillings ($.43 to $1.05) to the large free cinema shows presented for advertising of one sort or another (including soap companies and foreign embassies). Only rarely are film shows conducted by the Tanzanian Government's Information Ministry or is there access to locally produced films for entertainment, information, or education. One school (Msasani) included in the study is less than a mile from the Drive-In Cinema described in Chapter 1 while another (Madunga) was last visited by a cinema van in 1967. Most Madunga pupils probably had never seen films before.

In order to assess the pupils' immediate access to film viewing, the questionnaire asked the pupils to estimate their viewing experience for the past year by selecting: no film shows seen--category 1; one to five film shows--category 2; six to ten film shows--category 3; more than ten film shows--category 4 (see questionnaire, Appendix 6). The null hypothesis stating that filmic comprehension would not differ across these levels is evaluated using the data from Tables 27 and 28.

TABLE 27

H_8: Viewing Experience Data

Category[a]	N	$\overline{X}$	S.D.	s^2
1. none	242	65.66	8.80	77.3968
2. 1-5	531	67.66	8.39	70.4198
3. 6-10	180	69.32	6.16	38.0068
4. 10 +	314	68.41	7.37	54.2742

[a]Number of times pupils viewed film shows in past year.

TABLE 28

H_8: Viewing Data - t tests

	s^2 ratio				t tests			
Category	1	2	3	4	1	2	3	4
1. none	-	1.10	2.04*	1.43*	-	3.022*	5.023**	3.915**
2. 1-5	-	-	1.85*	1.30*	-	-	2.840*	1.359
3. 6-10	-	-	-	1.43*	-	-	-	1.475
4. 10 +	-	-	-	-	-	-	-	-

$^*p<.01$

$^{**}P<.001$

Viewing experience was included as a covariate in Table 7. The F ratio for viewing experience was nearly significant (p = .017). The Pearson product-moment correlation coefficient was low enough (r_p = .11) to eliminate reasonable prediction of scores based on knowledge of viewing experience.

The null hypothesis required statistically similar mean scores for the various viewing experience levels in order for acceptance. This was not the case and the null hypothesis is rejected. The overall data indicate a tendency for filmic comprehension scores to increase but the correlation is too low for useful prediction for individuals. Other population variables have different configurations of mean scores and viewing experience levels which are of greater interest than the overall sample. These population variable data are summarized in Table 29.

One of the puzzling aspects of both Tables 27 and 29 is the general increase of filmic comprehension mean scores with viewing level until the third category (6-10 times in past year) where a peak is reached and then the mean score drops for the final category. Nine of the 14 rows in Table 29 exhibited this tendency while 2 more maintained a constant increase beyond the third viewing category. Some of these increases were quite slight and not statistically different but the overall trend was firm in showing a gradual increase and then dropping back on the fourth viewing category.

The reasons for this rise and then fall are not clear. The explanation which the investigator tentatively accepts is that those who checked the third category were probably more precise in their approach to the testing situation and perhaps more aware of film shows than some of those who indicated they had seen more than ten film shows in the past year. A few who checked level four were not in locations where they could have seen that number of films. For example, 12 pupils from rural isolated schools checked viewing experience category four. There were no reasons to support their responses, i.e., no town

TABLE 29

H_8: Viewing Data - Population Characteristics

Characteristic	Viewing Categories[a]											
	None			1-5			6-10			10 +		
Geography[b]	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.
Rural: w/o town	159	64.65	8.48	94	64.90	8.09	10	65.00	4.90	12	63.58	7.08
Rural: w/town	54	69.13	8.00	142	70.84	5.37	42	70.90	4.90	39	69.90	5.53
Urban	29	64.69	10.47	295	67.00	9.20	128	69.14	6.46	263	68.14	7.54
Region												
Arusha	105	64.70	8.71	109	65.72	8.64	23	65.96	8.09	43	66.65	5.88
Coast	54	66.80	9.47	164	69.15	8.46	61	70.70	4.88	109	68.39	8.52
Kilimanjaro	25	62.44	8.48	114	67.48	9.17	49	67.82	6.82	90	68.47	6.34
Morogoro	58	67.71	7.97	144	67.58	7.15	47	70.74	4.93	72	69.40	7.43

TABLE 29--Continued

Characteristic	None			1-5			6-10			10 +		
Sex	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.	N	$\overline{X}$	S.D.
Male	159	66.81	7.63	318	67.00	8.17	114	69.72	5.95	236	69.01	7.35
Female	83	63.45	10.38	213	68.63	8.63	66	68.64	6.50	78	66.58	7.15
Age (Years)												
11-12	18	64.78	8.56	57	65.63	9.44	23	65.52	8.15	34	65.65	7.06
13-16	171	65.04	8.90	395	67.73	8.58	134	69.75	5.84	236	68.59	7.57
17-19	53	67.94	8.30	79	68.75	6.20	23	70.61	4.32	44	69.55	6.02
Education												
Standard 6	104	64.06	9.56	128	65.43	7.80	47	67.32	6.98	74	65.74	7.57
Standard 7	138	66.86	8.00	403	68.36	8.46	133	70.03	5.71	240	69.23	7.12

[a] Number of film shows attended in past year

[b] Pupil town-experience: School category

experience and no film shows in that area during the past year.

The explanation for the viewing results may be based less on viewing experience than on a combination of other factors. For instance, the rural schools w/o town experienced pupils made up the majority (n = 159 out of a total of 242) of viewing experience category one in the geography characteristic and had a low mean score (64.65). For the same geographic group, those with viewing experience category two had only a 0.25 increase in mean score. The urban school pupils numbered only 29 in category one with nearly the same mean score (64.69). Their numbers increased ten fold for category two and that category's mean score was significantly higher than that of category one. Too much analysis can be carried out, however, and the above example illustrates that any detailed evaluation of the population hypotheses must consider secondary factors as well as the main dimensions.

In summary, the null hypothesis for viewing experience is rejected and the alternative hypothesis, which states that filmic comprehension is different for different viewing experience categories, is accepted. Closer examination of this statistical decision reveals a less clearcut situation, however. Knowledge of an individual's viewing experience is not a predictor of filmic comprehension. Other population variables such as his school's geographic location, age, and sex appear to influence filmic comprehension to varying degrees with respect to viewing experience categories. The relationship between viewing and filmic comprehension as measured by this study is clearly complex and not the simple direct relationship suggested by the alternative hypothesis.

Reliability and Validity

The observation just made about the reliability of viewing experience responses raises the larger question of reliability of other responses--the personal information responses and even the test itself.

Since the test was designed as exploratory and administered under field study conditions, it was not expected that a detailed test reliability analysis would be conducted. An approximation of a test's reliability is found in Adams (1964, Table 3.5, p.88). This table is an adaptation of the Kuder-Richardson Formula 21 and requires only the number of items and the standard deviation after determining if the test was "easy" or "difficult" depending upon percentage of correct scores. Using n = 40 as the number of items entry (since this test's score gave two points per item rather than the normal one point) and 0.1 x n as the standard deviation entry, the tabled reliability coefficient is .62. Given the nature of the test and its usage (group rather than individual emphasis), this is a respectable reliability coefficient. Any replications should certainly yield a higher coefficient.

The personal information data is less susceptible to statistical scrutiny. Ages in Tanzania are more casually defined than in statistically-minded industrial countries. The situation is more akin to America's earlier days when birth certificates were nearly non-existent. From a non-African's perspective in comparing pupils' appearances with their stated ages, there was little reason to doubt the ages put down by the pupils.

Similarly, the data on town experience must be taken at face value. Schools closest to towns had the highest rates of town-experienced pupils. The investigator was arbitrary in defining town experience as more than a year's residence in an administrative center for a region. No finer lines were drawn than town/no town. Any finer distinction would necessitate direct questioning of the pupils.

The viewing data is perhaps the most suspect since the nature of the question posed and the lack of experience in filling out "check here" questions should lead to more inaccuracy than direct questioning. It was decided to retain all answers at fact value in the belief that any departure from the actual distribution would emphasize more viewing experience rather than less. This supposition may have been borne out by the results, which indicate a decreased fourth category mean score.

The study hoped to measure filmic comprehension and then to profile various population variables as related to the filmic tests. The content of the tests included a great number of basic filmic ingredients. Editing and story variables were excluded but nearly all of the basic filmic ingredients, including nine different camera techniques, were incorporated into the overall design. The content validity must be regarded as high. Two other types of validity--predictive and construct--should be examined more closely, however.

Strictly speaking, without more data which relates the study's findings to the perception of shots in a complete film, nothing can be said about the predictive value of the findings other than that pupils with little background in film viewing did comprehend filmed images treated in a number of different ways. The actions shown on the screen were familiar to the primary school pupil. Few pupils had difficulty in describing what they saw after a relatively short exposure to the film shots--often beginning to write before the standard shot time of five seconds had elapsed.

Less clear is the relationship between the pupils' filmic comprehension and their more conventional scholastic ability--which reflects the complex ingredients of intelligence, family background, motivation, etc. The constructs of the test were aimed at determining filmic comprehension of literate adolescents. Some of the results indicate that part of the test's variance must be attributed to scholastic abilities, testmanship, Swahili facility, and the school's educational environment. These are basic measurement questions of great interest in Tanzania at the present time. The difficulty of sorting out filmic perception from these more general measurement issues is why the investigator specifically chose to use the more inclusive concept "comprehension" to describe the measurement employed by the study. It is believed that using this broader concept is a relaistic compromise in the face of virtually no previous research which would allow isolation of "perception". The degree to which filmic comprehension was indeed measured and described is a matter of future theory and research involving not only films but other perceptual and ability measurements.

Chapter 5

Summary and Conclusions

The clearest result of this study is that Tanzanian adolescent school children with a wide variety of geographic, age, and prior film viewing backgrounds can easily comprehend the action in 16 widely different combinations of perceptually oriented filmic elements when presented shot by shot with familiar, readily understood content. More specifically, the research indicated the following evaluation of four population hypotheses:

1. Color vs. black and white. There was no significant difference between the results of the two chroma conditions.

2. Animation vs. live action. The live action rendition was more accurately comprehended than the animation rendition of the same content ($p<.001$). The interaction of camera mode with the type of background was significant ($p<.01$).

3. Plain vs. complex background. The use of a plain background significantly improved comprehension over the complex (ordinary) background ($p<.001$). The interaction with camera mode was such that live action with a plain background was best and animation with a complex background was the least successful of the four possible combinations.

4. Silent vs. sound. There was no significant difference between the use of realistic sound effects and no sound.

5. Rural vs. urban. There was no significant difference between pupils attending rural schools and those attending urban schools. However, two distinct types of rural schools emerged--rural isolated and rural schools with a large percent of urban-experienced pupils. Using a three way differentiation, rural schools with urban-experienced pupils had significantly better comprehension scores than urban schools or rural isolated schools ($p < .001$). There was a significant difference between the rural isolated and urban schools favoring the urban pupils ($p < .001$).

6. Males vs. females. No overall significant difference was found between the sexes, although in various combinations of viewer characteristics, differences were found.

7. Age level. Three distinct age levels were identified from a graphed presentation of comprehension by age levels ranging from 11 to 19 years. A significant difference was found between the 11-12 year group and the 17-19 year group ($p < .001$) but a Pearson product-moment correlation between ungrouped age and score was not significantly different from zero ($r_p = .08$).

8. Viewing experience. Four levels of viewing experience over the past year were compared with comprehension scores. The data indicate significant differences in favor of those seeing films more often, but only to a certain point where the trend drops off. A Pearson product-moment correlation indicated quite low predictive power of this factor for comprehension scores ($r_p = .11$).

An unplanned event was the use of Standard 6 pupils in the testing. Comparison of Standard 6 with Standard 7 indicates that increased education meant significantly larger comprehension scores ($p < .001$). This education factor was inserted into the analysis as a covariate along with age, town experience, and viewing experience. However, a point biserial correlation was low ($r_{pb} = .183$, $p < .001$) suggesting negligible predictive power of filmic comprehension for individuals based upon education level.

The limitations of this study should be clear:

1. Intact groups of varying size were selected to represent categories of Tanzanian primary schools rather than a random sampling of individuals. (See Appendix 7 for an elaboration of statistical limitations.)

2. One set of stimulus materials was used, as is typical of many media studies. Some isolated ambiguities appeared which seemed peculiar to regions (See Appendix 6). Steps were taken to insure a variety of typical camera techniques and that content was familiar to all groups.

3. Testing was conducted under actual classroom situations which produced variations in viewing conditions from group to group. The correlation of scores with light level was low and not significant ($r_p = .15$, $p < .05$), but some scores were affected by seating position (Appendix 4).

4. The results are based on a relatively unused technique in film research: testing shot by shot rather than entire films. The effects of accumulating shots into sequences and sequences into total films cannot be surmised from this study without further investigation,

although the results generally agree with studies involving complete films.

5. The testing situation was a novel experience for the pupils and such factors as motivation, anxiety, test experience, etc. may introduce measurement error.

6. It is unknown how individual variation in scholastic and intellectual capability affected the results because standardized instruments for measuring these factors are not available in East Africa.

7. The use of a verbal sound track was not tested, therefore it is not clear how a verbal sound track would alter the results.

Experimental Conclusions

The lack of information about how certain basic elements are comprehended has impeded a logical film research strategy. This study has attempted to initiate meaningful research into key film decisions and viewer characteristics by using a simple technique that can be adapted for pretesting films as well as for film research. Using shots rather than complete films, it has been relatively easy to gather a large quantity of data which generally fit with findings in pictorial, film, and viewer characteristic research elsewhere in Eastern Africa. The results for the filmic variables are quite clear. The optimum combination of elements are live action with a plain background made in either black and white or color and either with or without sound effects.

The most difficult finding for filmmakers to accept is that under ordinary filming conditions color does not increase filmic comprehension. Future conceptual frameworks and research techniques may disclose other dimensions (attitude, retention of information, lack of education, etc.) where color does provide a decided advantage over black and white, but no such research exists as of this writing. Nor was there a meaningful interaction with other filmic elements which might suggest using the more expensive color stock over the humble black and white film.

In terms of the Forgus (1966) model, chroma occupies an inactive role in the hierarchy of perceptual segregations when other sensory and experiential factors serve to identify the stimulus. Thought should be directed toward determining the conditions where the use of color is decisive for correct and complete comprehension. It appears that those circumstances are infrequent in general filmmaking and that the figure-ground relationship plays a more fundamental role in determining filmic comprehension.

It is quite true that color is virtually the only film stock now used in the industrialized nations for educational films and television production. Besides the simple fact that, given a choice, people prefer a color version of a film to a black and white version, more money is available in the industrialized nations to cater to this preference. If the choice is between producing one or four equally effective films, however, most educators would opt for quantity--which means the use of black and white stock.

Another conclusion which is hard for the filmmaker to accept is that using a uniform--plain--background produced higher comprehension for both animation and live action than the typical realistic background. There was more than one standard deviation between the plain background live action combination and the complex background animated figure combination. The difference was less for the two backgrounds in live action, however. Too much detail and too many distracting objects apparently cause the viewer to have greater difficulty in attending to the central action.

The implication is that when a shot or sequence of shots is particularly relevant to a film's purpose, a simple background should be used. This can be achieved in several different ways. Using a plain wall, or shooting against the sky, or using a set without props will produce a higher level of comprehension than the realistic setting as long as the setting is not important to the central figure's activity.

Another way of reducing distracting backgrounds is to use long lenses which throw the background out of focus. Ironically, the separation of figure from background becomes more of a problem with black and white film than with color. The increased speed of black and white stock means the use of smaller diaphram openings with the resultant increase in depth of field. A closed down shutter, neutral density, or other filters and a longer than normal focal length lens is suggested if a plain wall is not available.

Realistic human figure animation was compared with the live action equivalent. The pictorial research literature suggested that the more finely detailed, more realistic live action cinematography would produce a higher comprehension level than the animated drawings. This expectation was confirmed. The interaction of the figure-ground combination was also confirmed. The combination of animation with plain background was quite superior to animation with a realistic background. But live action with a background was better than either type of animation.

While animation production in Africa is exceedingly rare at the present time, certain subjects are ideal for animation--historic and folk tale topics, for instance. This study points out the comprehension difficulties in using illustrated figures rather than direct photographic techniques. Perhaps a compromise is puppet animation, which has a greater number of depth cues than illustrations.

Realistic sound provides different information about an event than the visual image. The use of only realistic, non-verbal sound effects with filmic visuals had not been studies before and it was unclear what would result.

The results in this study show a strong tendency for the silent shots to be more easily comprehended than the same visual shots with sound effects, but this finding was influenced by education level. It may be that the sound effects created perceptual interference with the visual channel even though they were redundant in content. Logically, the sound effects should serve only to provide a more realistic setting for the visual images and not as aids to comprehension. If the subject is unrecognizable in the visual mode, the sound effect will most probably be equally or even more unfamiliar. This assumes that most sound effects are less perceptually precise than the visual image of the action generating the sound.

The less educated children (Standard 6) may have relied upon the sound effects for a large share of the information needed to complete the experimental task. The task, however, was best accomplished by relying upon the visual channel of the motion picture. The scoring procedure gave points for discriminating man from boy, hoe from axe, etc.--information not available in the sound effects. When education was used as a covariate, the audio main effect F ratio diminished to below the selected significance level.

In a study published after completion of this investigation, Ball (1971) reported that Standard 7 pupils in Kenya did consistantly better than either a group of teachers or their Standard 6 colleagues (n = 461) in identifying 20 realistic sound effects used for radio porgrams. Applied to this study Ball's (1971) finding suggests that if Standard 7 pupils relied on sound effects as cues in the filmic comprehension test they more accurately perceived the cues than the Standard 6 pupils. A more plausible explanation is that the Standard 7 pupils were more experienced in following the investigator's directions, which stressed the visual image in completing the test.

While the social role of women may be considered inferior to that of men in Tanzania, they were clearly able to perform equally as well, and in some cases better, than their male counterparts. The decisive overall statistic is the zero point-biserial correlation of sex with score: $r_{pb} = .04$, i.e., no sex difference.

In testing unschooled children and adults, some differences might arise, as suggested by the poorer showing of Standard 6 girls in traditional as opposed to more cosmopolitan areas. Filmmakers dealing with topics of specific interest to rural unschooled females should carefully indicate the educational level of the intended audience in the light of these findings.

The study revealed that pupils attending schools with a high percentage of urban-experienced pupils were superior in their filmic comprehension to pupils of either urban or isolated rural schools. It appears that the urban-experienced pupils may affect school quality, which in turn influences the perceptual experience of all the pupils. This conclusion is based on finding a significant difference between types of schools rather than a significant difference between those pupils with urban experience and their non-urban experienced classmates in the same school. Two of the four schools in the category of "rural with urban-experienced pupils" were boarding schools accepting day students. This strongly hints at the classic explanation that socio-economic and parental education level affect pupil achievement and school quality, since higher fees are required for boarding the pupils and these must come from the parents.

Rural isolated schools did not differ in overall appearance from the other schools; in fact two of the most isolated schools seemed to have more classroom pictorial material in evidence than many urban schools. However, competency in Swahili was important in determining test scores. While the rural pupils all have had their education in Swahili, the mother tongue of nearly all of the isolated rural school children was not Swahili (as contrasted with many urban pupils). This linguistic explanation may account for the relatively poor performance of rural isolated females, who have less practice with Swahili than males.

Language facility may also account for Arusha Region pupils performing significantly worse than those in the other three regions. It is the one region tested which has severan non-Bantu based languages. The two most isolated schools were also found in Arusha Region. As research techniques for filmic comprehension emerge which do not rely as strongly as this study upon language facility, replication in traditional language areas might be fruitful in isolating the constraints of language in filmic comprehension tests.

Somewhat surprisingly, when the ages of the pupils were divided between the 11 to 14 year olds and the 15 to 19 year olds, there was no significant difference in filmic comprehension. However, the 11-12 year olds did significantly worse than the 17-19 year olds when three groups were formed. The tables presenting the age data are less meaningful than the correlation of age and score ($r_p = .08$). The conclusion can be made that the perceptual development of the majority of pupils with respect to this filmic comprehension test had stabilized. The isolated differences between certain groups which did occur may be attributed to experiential factors for pupils repeating a grade level (hence older) as well as greater language and normal scholastic facility of those in Standard 7 over Standard 6. Refinement of testing procedures for use in lower grades would be fruitful in examining the effects of perceptual development.

Of particular interest to filmmakers are the findings about viewing experience. Those with no viewing experience did significantly more poorly than pupils often seeing films. Although the viewing experience covariate F ratio was close to significance ($p = .017$), the correlation was too low to give any predictive power to knowledge of an individual's viewing habits and his score ($r_p = .11$). This conclusion was strengthened by finding no difference in the mean scores between the group indicating 1 to 5 film shows seen in the past year and those indicating 10+. However, doubt is cast on the reliability of reports of more than 10 film shows seen in the past year for some of the pupils.

The suspicion must be raised that the closest obvious experience relating to filmic comprehension is, in fact, not necessarily the most relevant. Deregowski (1968), for example, found that mere exposure to a rich pictorial environment by domestic servants working in European homes in Zambia was apparently not enough to enable the servants to perform comparably with schoolboys in depth perception tests.

Another explanation is that the filmic comprehension test used in this study was exploring more basic perceptual tasks than those learned in repeated visits to film shows. The test is, in effect, insensitive to prior viewing--although those not seeing films over the past year (or ever before) were statistically separated from the categories of viewers, particularly those indicating 6 to 10 times.

It would be quite desirable to have a quick, simple index of filmic comprehension based on an estimate such as film viewing habits, but it seems clear that other, more fundamental factors determine basic levels of filmic comprehension. Serpell and Deregowski's (1972) recent attempt in Zambia to improve depth perception by Standard 7 pupils using pictures and films in training sessions did not yield impressive results considering the efforts involved. Even specific perceptual training apparently requires greater insights than are currently available in order to alter perceptual characteristics of individuals.

The most important overall finding was stated in the first sentence of this chapter: Tanzanian school children could accurately describe the objects and actions over a wide number of filmic methods of presenting the actions on the screen. Their responses did vary with the way an activity was portrayed filmically, but the deviation was not very great and was generally caused by omitting the names of objects rather than by misconception of what was shown on the screen.

Technical Conclusions

Since all filming was conducted in super 8mm and all projection done under daylight conditions (again with super 8mm) in school classrooms, the investigator feels confident in stating that the super 8mm format deserves serious consideration as the standard gauge for educational films in East Africa. Regular film shows after the testing using super 8mm films reinforce this confidence. The technical details of production and projection are found in Appendix 4.

From the standpoint of pupil comprehension of the super 8mm format for both production and projection under daylight conditions (onto an appropriate high gain screen), there can be no question that acceptable levels were attained.[1] From the measurement point of view, a valid criticism of the test is that it was too easy. If the stimulus materials had been part of a total film, the results would be highly encouraging, since a filmmaker strives to have the shots as comprehensible as possible.

Film research can be expensive. This study has shown that an inexpensive super 8mm system is a viable tool of the researcher working under rugged field testing circumstances. It is cheaper and simpler than video tape systems and allows group testing with large screen projection. Many film research studies have used off-the-shelf 16mm films as stimulus materials because of budgetary restraints. With the super 8mm format, researchers can generate their own experimentally controlled stimulus materials quickly and inexpensively. No study surveyed by this investigator has shown that a slick, polished production improves learning over a simple production covering the same content. Quite bluntly, to neglect the use of super 8mm is to throw money away needlessly--especially with the rapid advances taking place in technical phases of the format.

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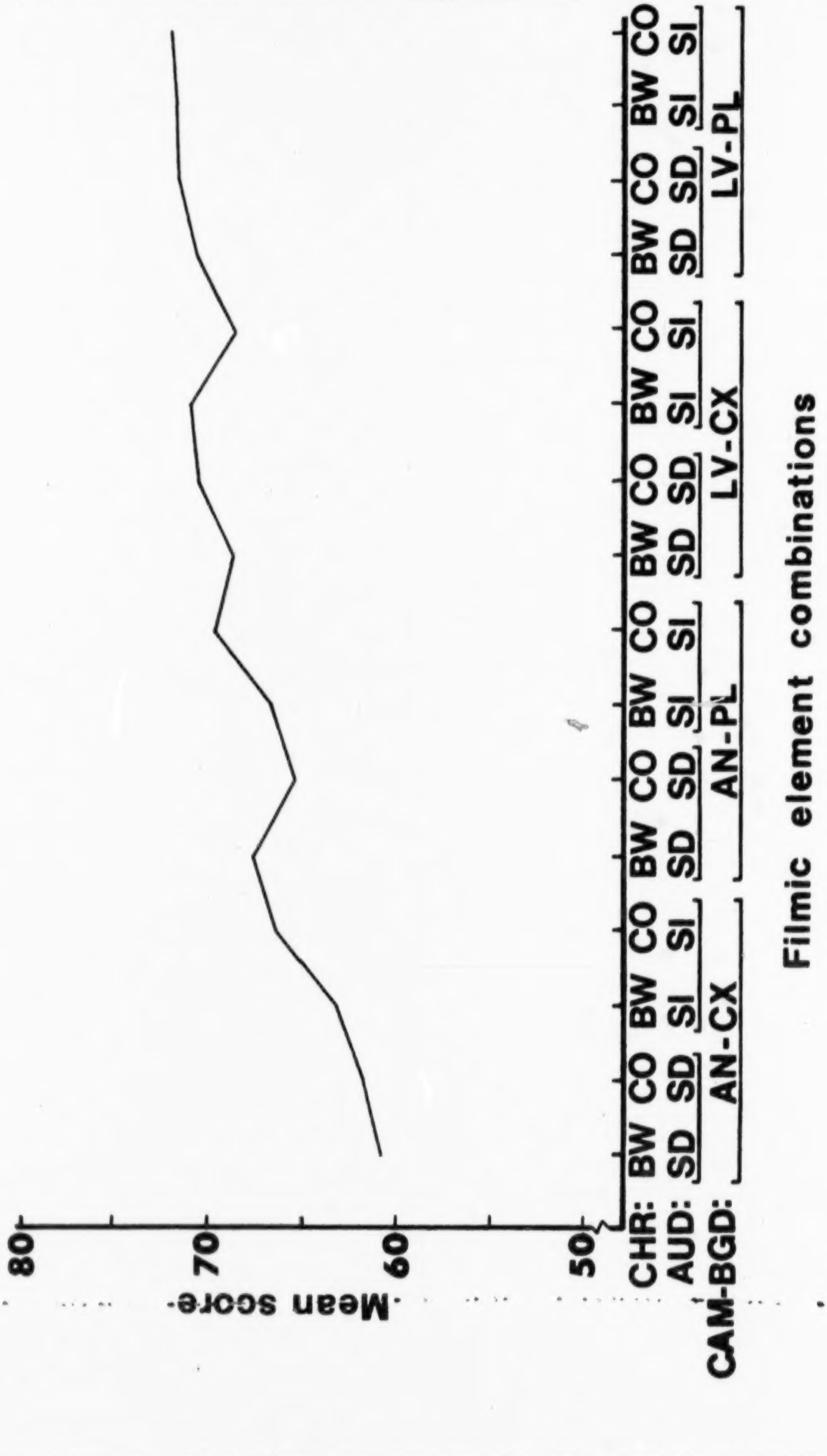
[1] 24 pupils (2%) achieved perfect scores and half of all the pupils achieved a score of 70 out of a possible 79 points (equivalent to 88 on a 100 point test). The single score achieved by the most pupils was 73.

Theoretical Considerations

Several questions arise about selecting the Forgus (1966) perceptual hierarchy as the theoretical framework. Was it appropriate? Was it too general or vague? Did it provide insight into the design of the study? Was it relevant in drawing conclusions? One way of answering these is to discover if there was a perceptual pattern revealed by the data. Figure 16 displays a plot of the means of the cells in the 2^4 factorial design.

The abscissa was developed by selecting the four possible combinations of camera mode vs. background and arranging them in ascending order of mean score. The other factor which was significant in the ANOVA of the 2^4 factorial design, audio, was arranged with the two silent treatment combinations preceeding the two sound treatments within each major combination. The black and white was selected as first of the chroma elements because the mean for black and white sound was lower than for color sound in the first combination, animation without background. Having established this order, the

Fig. 16. Perceptual hierarchy: mean score vs. filmic element combinations



nonsignificant chroma elements alternate thereafter.

The slope of the line is not large but the general pattern of a hierarchy is present. The gentle slope serves as a caution against claiming dramatic differences between the combinations of elements tested but is clear enough to support the notion of some kind of hierarchy. If the testing had used sequences as stimulus materials and the task of recall had been more complex, the differences might have been greater than has been established for a five second shot of a simple repetitive action.

Forgus (1966, p. 22) suggests that at the lower levels of the perceptual hierarchy sensory factors dominate and that experiential factors become increasingly dominant as the tasks become more complex. While combinations of certain viewer characteristics showed significant effects on filmic comprehension, the overall correlations of score with age, sex, geographic location, education, and past viewing experience were small. These low correlations indicate that the test was either insensitive to experiential factors, i.e., more related to sensory factors than to problem solving, or that the viewer characteristics examined were not the relevant ones. The overall results of the study indicate the test was examining sensory rather than problem solving factors--and, as such, the role of experiential factors was diminished.

Future Research Directions

The usual remark at this point is to state that additional research is necessary. In fact, a primary assumption of this study was that it would provide normative information and serve as a preface for additional research. With a dearth of Eastern African research on all aspects of pictorial and filmic materials, a reasonable starting point was comprehension of basic shots. Future research leading from this study goes logically in several directions: (1) different categories of filmic stimuli, (2) greater population diversity. (3) cross-cultural comparisons, (4) methodologies and research techniques, and (5) interactions among all of these as related to a perceptual hierarchy and other theoretical issues.

The next level for filmic elements beyond the shot is the sequence--several shots combined to convey an idea or describe an event. Roughly, a shot is to a sequence as a sentence is to a paragraph. With the introduction of variation in shot length and order of shots, the perceptual task becomes more complex for the viewer and the assumptions of comprehension more unsure for the filmmaker.

Going in the other direction from adding one shot to another is the comparison between the still picture and the "moving picture". The element of motion would be isolated by comparing a still picture of the action with a motion picture shot of the same scene--a simple experimental task leading from the techniques of this study. The information would be quite revealing about the difficulties of pictorial perception and the function of motion in perception.

One of the potentially powerful tools for communicating with people having little or no literacy is the motion picture. Knowledge gained from the adolescents in this study is limited to those with primary school education. Using the same techniques of single shots and familiar action, results from testing nonliterates would help reveal the possibilities and limitations of films as educational media for adult nonliterates--the majority of East African adults.

Under the findings for age variation, the investigator noted an apparent perceptual stability of the adolescents with regards to the experimental task. Experimental work with younger children would help pinpoint the filmic comprehension growth patterns. Results from testing the still and motion picture combinations with age variations would yield insights into educational media usage in addition to cognitive and perceptual development.

All of these research problems are suitable for cross-cultural comparisons. The design of this study was developed to minimize constraints on replication in another culture. The basic actions could be used almost anywhere in the world with only the actors and the backgrounds changed to make them appropriate to other cultures. Indeed, the actions are not sacred at all: The principle is the testing of thoroughly familiar activity when transferred to a cinema screen. Cross-cultural testing would contribute to working out a fundamental problem which was approached in this study but not adequately solved except, perhaps, negatively: What are the viewer characteristics which contribute to filmic comprehension?

The need for more sophisticated methodologies and research techniques is apparent. The paper and pencil test is not applicable for the low level literate or the nonliterate. Yet the clear need to maintain attention to interaction between variables is sobered by the requirement of large numbers of subjects--a major bottleneck without the mass data gathering capacity of the paper and pencil test. The investigator has given serious attention to the question of unobtrusive eyemovement techniques which reveal where the eye moves in seeking perceptual data, but feels that the technical difficulties are still major blocks to successful data gathering. Some form of observational technique will have to be supplemented with a verbal response, it is felt, in order to begin serious exploration of non-literate population filmic comprehension. The use of pictorial choices following the viewing of a shot is not satisfactory unless the subject has a high level of pictorial sophistication--which usually is associated with education.

In this study, the factorial research design was used. It is a highly useful design and amenable to this sort of research where various dichotomies exist together. Other designs which include several filmic elements and subject groups would also be useful. The nature of the experimental task and the emphasis on producing guidelines for practical purposes will always work against the simple designs strongly suggested by Lumsdaine (1963).

A theoretical framework--however crude--is always an asset for the researcher. It seems reasonable from this study that some sort of perceptual hierarchy is a desirable framework when used with caution. The interaction of many variables appears to be the fact of life in this type of research which examines perceptual tasks and explores the different kinds of viewer characteristics. The concept of a hierarchy becomes important in sorting out the nature of what is successful and what is not so successful in conveying information in the cinema. Testable hypotheses which relate to one another in a meaningful way can emerge from a tentative framework. One of the goals of this study is to provide a logical start for further research which pursues the questions raised by the intense interest of the Drive-In viewers described at the beginning of Chapter 1.

Appendix 1

Decisions Made in Educational Film Production

The following outline lists phrases and words which in the filmic context determine the nature of a motion picture. Taken a step farther and expressed in an orderly, logical flow chart for computer programming, they would be the decision points and IF statement. A film is something more than the sum of all these decisions--since the chain of choices made by the director or the editor interact and a symbiosis occurs when the viewer finally sees the completed film. To contend that each point requires research in order to provide credence for the decision is to have a shallow view of both the purpose of research and the nature of filmmaking as a craft and art. However, in the context of the developing nations where little is known about the audience's film viewing behavior--either intuitively or empirically--research exploring key decision points is both wise and in the long run more efficient than pure intuition.

The following loose outline with the even looser use of words and phrases is intended to highlight the many decisions which may be made in making a simple educational film. The list is included in this study because the choice of what to include in the study and what to exclude was made from it. Further refinement from theoretical considerations and greater precision in specifying the variables and the important interactions of variables is expected.

I. The Planning Stage
  A. Treatment Style
    Dramatic (literary, historical)
    Documentary (social problems, relationships, science)
    How-to-do-it (skills)
    Enrichment (art, music, dance)

B. Target Audience
  - Age
  - Sex
  - Education
  - Cultural Patterns
    - Language
    - Customs
    - Religion
  - Degree of film literacy (including prior viewing experience)
  - Other background factors (occupation, residence, socio-economic background)

C. Density of Concept to Be Conveyed
  - Visual and aural saturation
  - Repetition
  - Error analysis (skill films)
  - Time for information processing

II. Technical Decisions Prior to Filming

A. Film gauge: 8mm, 16mm, 35mm, 3-D
  - Cartridge loops
  - Classroom
  - Auditorium
  - Commercial

B. Color or Monochrome
  - Information relevance
  - Identification
  - Attitudes
  - Aesthetic

C. Silent or Sound
    - Language
    - Length
    - Content
    - Captions

D. Narration or Synchronized Sound
    - Language
    - Instructional effectiveness
    - Identification with subject
    - Treatment style: Didactic, verité, etc.

E. Music
    - Library or special
    - Treatment style
    - Aesthetic
    - Instructional value
    - Interaction with visual

F. Sound Effects
    - Treatment style
    - Understanding of visual
    - Instructional value
    - Aesthetic

D. Length
    - Instructional purpose
    - Content density
    - Treatment style
    - Audience characteristics
    - Program demands

E. Continuity

- Location
- Actors
- Props
- Lighting
- Discontinuity effects

F. Actors

- Language (if sound)
- Apparent background
- Reputation from prior films
- Appearance
- Ability
- Use of body language
- Affect

G. Props

- Relevant to content
- Understood by audience
- Non-distracting
- Believable
- Available

H. Location

- Indoors/outdoors
- Relevant to content
- Familiar to audience
- Minimum of distraction

I. Special Effects

- Slow motion (slowing complex movement)

- Time lapse (reducing long period to short span)
- Aerial (satellite perspective)
- Underwater
- X-Ray
- Microscopic
- Telescopic (astronomy)
- Infrared/ultraviolet (accents different rendering)
- Extend instruction
- Film literacy level
- Narration/visual clues

J. Animation

- Abstract concepts (not real people, things)
- Diagrammatic
- Filmograph (giving motion to still pictures)
- Information-over pictures
- Audience experience

K. Titles

- Information content
- First impressions

III. Technical Considerations During Filming

A. Lighting

- Mood
- Complexity
- Rendering of subject (filters also)

B. Camera Position

- Composition
- High/low angle

- Eye level
- Behind/in front of subject
- Subjective camera (where subject would be looking)

C. Lens Selection

- Wide-angle (can distort, give isolation)
- Normal (approximates eye's perspective)
- Telephoto (foreshortens, compresses, dramatic)
- Zoom (for instant change in perspective)

D. Acting/Action

- Continuity
- Appropriate for subject
- Direction
- Natural/believable

E. Type of shot

- Establishing
- Re-establishing
- Long
- Medium
- Two-shot
- Close-up
- Big Close-up
- Pan/tilt
- Dolly in/out
- Tracking
- Zoom
- Focus change
- Reverse angle

- Over-the-shoulder
- Combinations of two or more

IV. Technical Considerations: Editing

A. Order of Shots, Scenes and Sequences

- Intrinsic logic
- Time (Flashbacks included)
- Spatial
- Convention related to subject
- Juxtaposition
- Dramatic
- Continuity techniques (cutaway)
- Aesthetic

B. Inclusion/Exclusion of Shots, Scenes and Sequences

- Instructional value
- Relevance
- Sophistication of audience
- Total length of film
- Parsimony
- Aesthetic

C. Length of Shots, Scenes and Sequences

- Relevance
- Instructional value
- Smoothness of action
- Dramatic intent (pacing)
- Sophistication of audience

D. Use of Opticals

- Fade in/Fade out

- Dissolve
- Wipe
- Montage
- Keyhole
- Information-over
- Split screen

V. Technical Considerations: Sound

A. Narration

- Vocabulary level
- Language/accent
- Syntax
- Sentence types
- Relationship with picture
- Delivery style
- Male/female/age of narrator

B. Music

- Style appropriate for subject and audience
- Adds to enjoyment (audience attitude)
- Convention
- Mood
- Familiarity
- Aural cueing

C. Sound Effects

- Location vs. studio
- Relationship with picture and narration
- Instructional value (information)
- Dramatic value

- Greater sense of reality
- Aural cueing

D. Final Sound Track Mix

- Intensity of each channel
- Lead/follow picture
- Information load

VI. Final Preparation and Viewing

A. Quality of Final Prints: Picture

- Balanced exposures
- Balanced color
- Fidelity to original

B. Quality of Final Prints: Sound

- Fidelity
- Level

C. Viewing Environment and Conditions

- Ambient light level
- Type of Screen (front, rear, surface)
- Image size
- Projector condition (optics, speed, sound)
- Acoustics
- Extraneous noise (projector, traffic)
- Seating conditions (including viewer density)
- Room climate (temperature, humidity)
- Position of viewer
- Sociological conditions (ease of conversation)

VII. Some Factors Independent of Production

A. Pedagogical Issues

Note taking during film

Repetition of film

Introduction and summary

Later review with filmstrips

Bare minimum for same learning

Transfer of attitudes toward teacher to film

Practice following skill film

Individual vs. group showing

Relationship to teaching techniques preceding and following film

B. The Individual Viewer

IQ

Learning style

Physiology (including EEG response, health, etc.)

Prior experience

Culture (including kinship, values, norms, etc.)

Attitudes

Expectations/anticipation

Degree of empathy

Age (Cinema quotient?)

C. Other Issues

Relationship between films and television

Multi-screen techniques

Correlation of film comprehension and still pictures

Cultural idiocyncracies

Comprehension level and filmmaking experience

Effects of feedback (programming)

Attitude studies and comprehension

Effects of films on motivation

Reinforcement value of films

Classification of films in a taxonomy such as Bloom's (1965)

Appendix 2

Tanzania: A Brief Description

The land is often baked dry but when the intense rainy season dumps much of the year's rainfall in two months there can be intense flooding. The Indian Ocean washes warmly and calmly against the sandy beaches while the pink snows of Mt. Kilimanjaro chill a mountain guide's bones as he watches the sun rise some 3° south of the equator. In the high valleys, wheat is combined by modern machinery within view of lion, elephant and buffalo. A mother watches helplessly as her infant wastes away from untreated dysentary. A luckier mother anxiously watches her child loaded into a flying doctor's airplane for treatment of burns and later plastic surgery at a modern hospital.

In the capital, a school teacher turned president struggles with ways of solving an illiteracy rate of 80% while American and British governments dump their surplus stocks of sisal to drive sisal prices down as punishment for criticizing their lenient policies toward the racism in Southern Africa. Chinese leave their dormitories for work on the 1,200 mile Tanzania-Zambia railroad, just as their ancestors a hundred years ago toiled on the railroads in California when no one else could be found. It is China's largest foreign aid project and is designed to provide landlocked Zambia with a route to the sea through a friendly country.

The heat of the day is wearying on the workers in the Olduvai Gorge as they painstakingly pursue the efforts begun by Dr. L. S. B. Leakey to push back the layers of gravel and reveal man's origins through million year old bone fragments.

In the cotton fields around Lake Victoria, farmers and their families pause for a rest, reflecting perhaps on the new cotton mills which have recently opened to move a step towards self-reliance and away from dependence on the traditional foreign sources. Development is a slow process. The slowness is symbolized by trucks taking the cotton to the cooperative centers. They must pass over secondary roads which shake their parts mercilessly, crawl through mud during the rainy season and dusty ruts during the dry time of year.

The country is large--several times the size of its two former colonial rulers, Germany and the United Kingdom. The people are spread out, dispersed, rural, and number only around 13 million. Despite more than ten years of independence, development proceeds slowly for many. There is frustration. But the task of eliminating poverty, ignorance, and disease is being pushed and pushed.

Many students strolling to classes on the airy new campus of the University of Dar es Salaam ("Africa's most expensive village," President Nyerere once quipped) argue how this should be done--how much can be achieved with the limited human and physical resources within and how much must come from the outside. They take for granted the leap forward they themselves have made in less than a generation --from the little village which may have had a bicycle as its most sophisticated machine--to the academic setting typical of small universities anywhere in the world. The classroom language was left by the rulers of forty years--English--but Tanzanians feel increasingly proud of their historic, rapidly-evolving national language--Swahili.

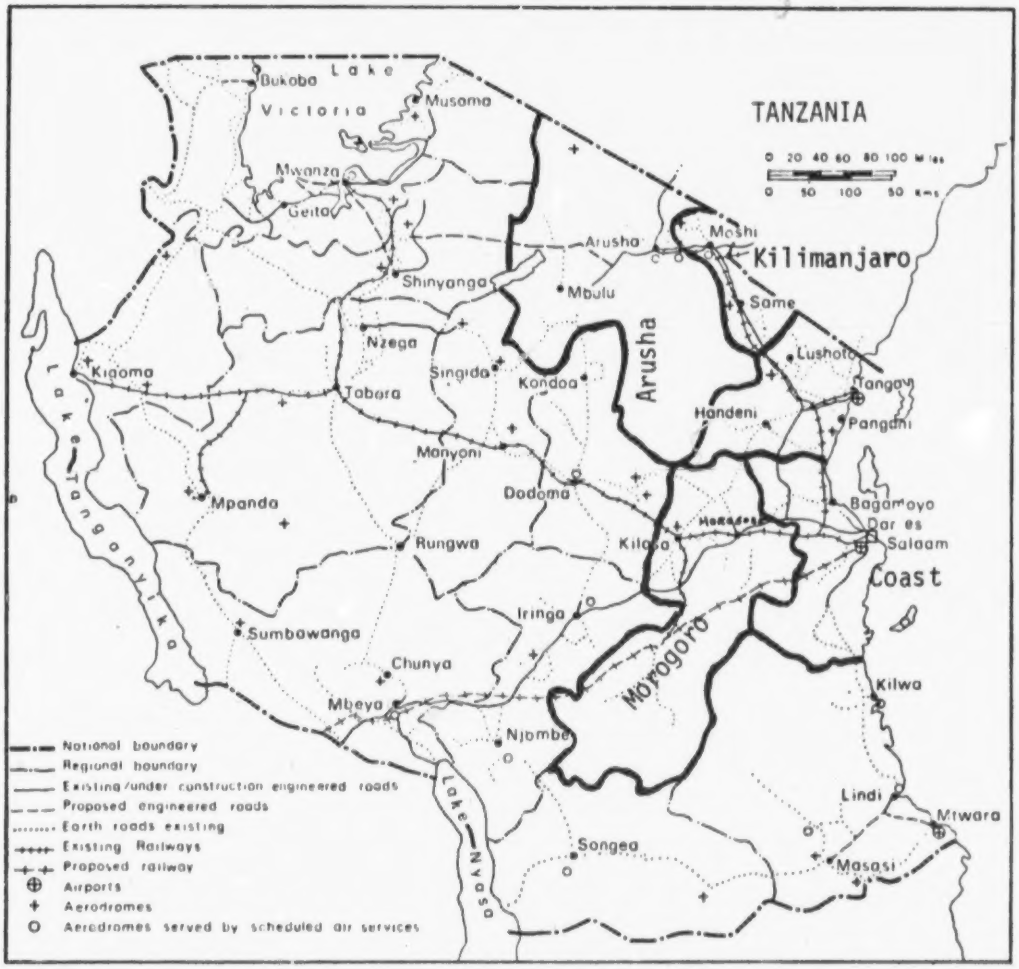
Under the shade giving mango and baobab trees, people talk of their problems, the latest news and whatever else serves to bind them together--to reaffirm their sharing of each other's lives. The Westerner feels a timelessness--the result, perhaps, of nearly uniform length of day and night and little variation in weather from day to day. But changes take place--partly stimulated by the government and the single political party, TANU. Old women begin to adopt Swahili and speak the tribal language less. A new classroom is added to the school down the road. A few more children will learn the rudiments of reading and writing. An old grandfather decides that it may be true that men did go to the moon. A new electric cable is being strung overhead.

The sounds of the cattle being driven into the thorn branch enclosure alert us that another firey sunset is leaving its embers on the horizon. The wind turns cool and the bolder, brighter stars emerge from the darkening sky. In New York, London, and Tokyo, the subway trains rumble onward, tossing their passengers to and fro.

Appendix 3

The Regions and Schools: Summary Information

Figure 17. Map of Tanzania indicating regions visited during study


TANZANIA
0 20 40 60 80 100 Miles
0 50 100 50 Kms
Lake Victoria
Bukoba
Musoma
Mwanza
Geita
Shinyanga
Arusha
Moshi
Kilimanjaro
Mbulu
Same
Lushoto
Tanga
Pangani
Handeni
Arusha
Nzega
Singida
Kondoa
Kigoma
Tabora
Manyoni
Dodoma
Lake Tanganyika
Mpanda
Rungwa
Kilosa
Morogoro
Bagamoyo
Dar es Salaam
Coast
Iringa
Sumbawanga
Chunya
Mbeya
Njombe
Kilwa
Lindi
Mtwara
Songea
Masasi
Lake Nyasa
National boundary
Regional boundary
Existing/under construction engineered roads
Proposed engineered roads
Earth roads existing
Existing Railways
Proposed railway
Airports
Aerodromes
Aerodromes served by scheduled air services

From Tanzania. Second Five Year Plan. Vol. 3

Arusha Region[1]

Arusha town and Region form the center of Tanzania's tourist industry which is based on the large numbers of wild animals and some of the world's most spectacular scenery. Lake Manyara, Mt. Meru, the Ngorongoro Crater, Olduvai Gorge, and part of the Serengeti Plains are within Arusha Region. But the sharp contrast of luxury hotels with isolated people living with few changes over the centuries has provoked a hot controversy within Tanzania about the highly uneven distribution of wealth within the region. Many of the people are not part of the Bantu linguistic groups which predominate in other areas of Tanzania. Wamasai, Waarusha, Wairawq, Wameru, and Wairangi constitute the bulk of this region's diverse population.

Cattle, wheat, pyrethrum (an insecticide), meerschaum (for pipes), coffee, forest products, small industry, and the highly visible tourist trade are the principle money earners. Arusha town is also the headquarters of the East African Community--the intergovernmental body which provides various services for Tanzania, Kenya, and Uganda. The higher elevations receive adequate rainfall but the plains are often dry and their suitability for large-scale farming is limited to possible ranching. The area is physically reminiscent of the American Southwest.

The four schools visited in Arusha Region included Uhuru and Naura primary schools in Arusha town and Daudi and Madunga primary schools in Mbulu District (regional sub-division). The testing took place between January 28th and February 2nd, 1971.

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[1] A summary of the data from each school follows at the end of this appendix.

Uhuru Upper Primary School. A large urban school with three streams of Standard 7. However, only one of the streams was composed of African pupils, primarily with Wameru and Wachagga backgrounds. A second was almost exclusively Asian and the language used was English --one of the few remaining English streams in the country. The third was racially mixed (predominantly African) with some of the lessons in English but most in Swahili. All three were tested but only the two Swahili speaking streams were used in the final sample. Electicity was available, but on a pillar outside of the classroom used for testing. Unlike typical Tanzanian classrooms, this one was wider than it was long. Benches and desks were pushed together from the sides to compensate for this size difference. The room was devoid of pictorial stimuli. Arusha has several commercial cinemas and various film vans provide occasional outdoor film shows. All testing was done in the morning.

Naura Primary School. A small school, Naura had only one stream of Standard 7. This meant that the Standard 6 pupils would be tested in order to meet the quota of two tests per school. Formerly a Roman Catholic mission sponsored school, it lacked electricity but was well built and had several posters in the classroom used for the testing. Many pupils had seen a film show from the National Parks Educational Unit the previous week. The testing was conducted during the early afternoon. As with the Uhuru school, most pupils were of Wameru and Wachagga background.

Daudi Extended Primary School. Located about 7 miles (11.2 km) from the minor settlement of Mbulu on the Mbulu-Karatu road and about 130 miles (208 km) southwest from Arusha, Daudi Extended Primary

School is in the rolling, open Mbulu highlands on the escarpment above Lake Manyara. The pupils generally lack contact with many 2-dimensional visual stimuli other than the few posters and books in the school. There are very few film shows in the area. As with most of the rural schools, there was one Standard 7 stream and one Standard 6 stream. The term "extended" means that it has recently become a full seven year primary school. Probably all the pupils were from the Wairawq group. The testing was conducted during the morning hours.

Madunga Primary School. The most isolated school in the study is about 30 miles (48 km) south of Mbulu minor settlement in a high, picturesque valley several miles off the road between Dongabesh and Dareda. The school is located at the base of several mountains which are forest reserves. There is a small shop and a dispensary. The people are part of the Wairawq group. They are rightfully proud of their school which was built after independence (1961) on a self-reliance basis. Several additions have been made to the brick and masonry structure since then. Many pupils had never seen films before but the amount of printed matter and posters in the school was equal to many urban schools visited during the investigation. Testing took place during the morning hours with the Standard 7 and 6 classes.

Coast Region

Dar es Salaam is the focus of the region with governmental, commercial, and industrial activity serving as magnets to draw people from all over the nation to jobs in a modern city. But in many ways the quality and pace of life outside the capital in the rural parts of the region remain unaffected by the city's presence. The Indian Ocean provides fish and the tropical climate of heat and humidity supports coconuts, cashewnuts, mangoes, and rice in abundance. The wide sandy beaches attract foreign tourists. Much of the region is sparsely populated, partly because of the difficulties of maintaining stable water supplies and partly for historical reasons reaching back to the 19th Century slaving which was centered in the nearby island of Zanzibar. Most of the people in the areas around Dar es Salaam are Wazaramo. Elsewhere in the region are members of the Wamakonde, Wakwavi, Wakwere, Warufiji, Wandengereko, and Waluguru communities. The constant exposure to Swahili in the Coast Region contrasts with inland regions where Swahili may not be used much in rural areas until a child begins school. In Dar es Salaam, Mnazi Mmoja and Msasani primary schools were tested. Mjimwema and Vikindu primary schools were visited in the region. Testing was between March 12th and 20th, 1971.

Mnazi Mmoja Primary School. This large, centrally located school has three Standard 7 streams, all of which were tested. With nearly 1,000 pupils, it is one of Tanzania's largest schools. It is set in an open area of the city and consists of several classroom blocks in a campus setting. Nearby is the national headquarters of TANU (Tanganyika African National Union), a community center, health clinic, and park. Regular film shows are scheduled in the open space near the community center and there are two commercial cinemas within several minutes walk from the school. The classroom used for testing had a few posters but was otherwise bare. Electricity was available in another classroom building but not in the one used for testing. There were a few pupils of Asian or Arab descent. While Dar es Salaam is the home area of the Wazaramo community, the cosmopolitan nature of the city makes it impossible to estimate the tribal background of the pupils at this and the following school. Testing was carried out in the morning hours.

Msasani Primary School. This older school is located on the edge of Dar es Salaam in a small, historic fishing village on Msasani Bay which is now surrounded by the spread of new housing characteristic of growing cities. The pupils come from both the village and the Oyster Bay area--sons and daughters of civil servants, house servants, manual laborers, and fishermen. Less than a mile (1.6 km) from the school is the Drive-In Cinema described in Chapter 1. Standards 6 and 7 were tested because the school did not have enough pupils for two streams of Standard 7 at the time of testing. It did not have electricity. There were a few pictorial stimuli in the classroom tested--the usual maps and posters related to nation building activities. The morning hours were used for testing.

Mjimwema Primary School. The small rural school at Mjimwema Village is six miles (9.6 km) from the city, across the mouth of the Dar es Salaam harbor. At the time of the testing, it had one stream of Standard 6, but no Standard 7. There are few signs that the capital is as close as it is. Being on the other side of the harbor mouth has inhibited the growth of the city although an oil refinery and port facilities have developed over the past few years. It is too far for many people to work in the town and regularly commute over the gravel and sand road. Most work as farmers, fishermen, or laborers in the nearby gravel quarries. The older youth have contact with the city, and the school was rated as one which had access to an urban center. There were few pictorial stimuli in the classroom. Most of the people in the area are Wazaramo. Testing was in the morning.

Vikindu Primary School. This school is a combination boys boarding and mixed day school. Since it is located about 14 miles (22 km) south of Dar es Salaam on a recently paved road, it receives some urban pupils as well as pupils from the rural area around it. The pupils were thus from urban and rural Coast Region and various other regions throughout the country. Both of the Standard 7 streams were tested, in addition to the two Standard 6 streams. Although nicely shaded in a campus setting, Kikindu's physical facilities were below average compared with the other schools. The classrooms were much larger, but the construction was not as solid; there were few pictorial stimuli. However, performance on the tests was high and the pupils appeared to be serious about the testing. The testing took place on a Saturday morning--usually a time set aside for diverse tasks around the school. Because of the heterogeneous makeup of the school, no judgement can be accurately made about the predominant tribal background of the pupils although the school is in a Wazaramo traditional area. Since it is a boarding school, it is fair to say that some of the pupils come from homes above average in socio-economic terms.

Kilimanjaro Region

Named after Africa's highest mountain, Kilimanjaro Region is Tanzania's wealthiest agricultural area. Favorable geographic location, soils, and climate have contributed to this relative prosperity. The people living on the mountain (Wachagga) have used their natural resources effectively in cultivating coffee for export and bananas for their staple food. Abundant water can be allocated among the farmers by gravity flow irrigation. The result has been high population densities on both Mt. Kilimanjaro and the range of lesser mountains in the region, the Pare mountains, named after their inhabitants the Wapare. But down on the plains, the lack of water is a major obstacle to agricultural development and to sustaining the overflow population from the mountains.

With their money, the people have built a number of schools, and the region has the highest primary school enrollment in the country with some areas having almost 100% enrollment (vs. the national average of 47%). Other educational and health services have been developed by the churches, government, and the major economic organization in the region--the Kilimanjaro Native Co-operative Union which is primarily a coffee marketing co-operative.

In the rural parts of Kilimanjaro Region, as in others, there is strong reliance on tribal dialects by the people. Unlike the towns where Swahili is learned early in life, rural young people often learn Swahili only when they begin school (rather than at home) where it is the exclusive language.

The tourist potential of the region is being developed with the recent opening of the Kilimanjaro International Airport. For the residents of Moshi, the regional center, films are viewed in several commercial cinemas and there are regularly scheduled open-air film shows brought in by commercial film vans, government, national parks, and the various churches. A few film shows are seen in the rural areas on a sporadic basis.

The schools which were visited between February 8th to 11th, 1971, included Majengo and Jamhuri primary schools in Moshi town, Mengwe Upper Primary School in Kilimanjaro district, and Usangi Girls Primary School in Pare District. Practically all of the pupils were of Wachagga or Wapare heritage.

Majengo Primary School. The main primary school in a residential area of Moshi, Majengo is set in a relatively open space surrounded by one story single and multiple family houses. A small market and beer hall are nearby. The school has two streams of Standard 7. Only one stream was used in the final sample because of technical difficulties with the sound system during the testing. The portable generator was used since the classroom did not have electricity (in some instances, such as Majengo, only one classroom or an office might have electricity). There were few pictorial images in the classroom. The classrooms were typical of the schools found in the warm areas of the country: two rows of wire mesh-covered openings serve as windows along the long dimension. These allow cross ventilation and a great deal of light. The front and back walls are solid. In the schools which have the money, such as Majengo, insulation boards are used as ceiling panels. Otherwise the ceiling is the inevitable corrugated iron or red Mangalore tile roof. Testing at Majengo was conducted during the morning.

Jamhuri Primary School. A small school in another part of Moshi, Jamhuri is on a residential side street with houses close together. Both Standards 6 and 7 were tested during the visit. The school staff was most helpful and interested in the testing. Many teachers during the study remarked that the teaching of pictorial perception was not stressed enough in the primary schools. The teachers were in some instances the most attentive to the task-training examples and at Jamhuri took the test themselves along with the pupils. The short eves on the roof, the westward orientation of one side, and the lack of shade trees, made light control more of a problem here than in other schools. My green curtains were supplemented by a blanket to reduce the light level. Once again, the generator was used in lieu of electricity in the classroom. Testing took place in the afternoon. The classroom walls were bare of pictorial materials.

Mengwe Upper Primary School. An upper primary school consists of Standards 5, 6, and 7. In this instance, there were two streams of Standard 7--indicative of the population density and educational commitment of the area. Mengwe (also called Kawawa by the pupils after one of the nation's leaders) was one of the newest and most modern schools visited. It was well constructed, very clean, and nicely landscaped. Located some 40 miles (64 km) from Moshi on a small side road off the main road through Rombo Division, Mengwe is surrounded by coffee trees and bananas. While there is relatively good road access to Moshi, it must be classified as a remote school. There were no film shows in the area during the few years prior to testing and few of the pupils (according to the head teacher) had travelled much. Testing took place in the morning.

Usangi Girls Primary School. This was the only girls school visited during the testing. It is in the heart of the North Pare mountains in the Usangi village area, 50 miles (80 km) from Moshi and 13 twisting miles (21 km) from the main road between Moshi and the district administrative center of Same. It serves both day pupils and boarding pupils. Most of the girls were from the Pare area with some from Moshi and other parts of Tanzania. There are two streams of Standard 7. Only one stream was used in the final sample because of an administrative error which duplicated a test already conducted elsewhere. Few schools matched the earnestness of these pupils and teachers (all female) in their learning and teaching activities. The pupils completed the experimental task quickly, efficiently, and with high achievement. While it is a geographically isolated school, a sizable number of the boarding pupils either live in a town or have lived in a town. The testing took place in their dining hall in the morning. The screen distance was the same as in a typical classroom.

Morogoro Region

Morogoro Region is a mixture of several mountain ranges, river valleys, and rolling plains. It is just inland from the lower altitude coastal strip and consequently enjoys a dryer and somewhat cooler climate. The administrative center is the town of Morogoro which is nicely situated at the base of the Uluguru range and is the junction of road links to the west and south. The region is becoming a national educational center. The Agricultural College of the University of Dar es Salaam, the Institute of Development Management, the National Food and Nutrition Institute, and other research and training establishments are located in various parts of the region.

Sugar has edged out sisal as the primary plantation crop with the government encouraging small farmers near the processing plants to cultivate sugarcane. Cotton, oilseeds, maize, citrus fruits, and rice are important crops. A new hydroelectric scheme at Kidatu will provide power for the Coastal grid using the Ruaha River's energy. The Tanzania-Zambia railway and an improved road link with Zambia are major development projects.

Most of the people in the region are linguistically and culturally related. They include the Waluguru, Wakaguru, Wasagara, Wakutu, and Wambunga. With a Bantu language base and historic contacts with the Swahili speaking coast, many are familiar with the national language from early childhood. Other groups have come into the area in the past to work on the sisal estates. With easy communication links with other parts of the country, many of the region's workers have travelled elsewhere. There are a few film shows given in parts of the region. Morogoro has a commercial cinema.

The schools visited in Morogoro town included Msamvu Primary School (boys boarding school) and Mwembe Songo Primary School and, in the region, Melela and Mikese primary schools. The region was visited between February 23rd and 25th, 1971.

Msamvu Primary School. This boys boarding school is located on the edge of Morogoro town and is populated by boys from many parts of Tanzania. While most pupils were from the Morogoro (Waluguru) area, it was probably the most geographically diverse school in the study. It is a well-worn school but one of the few with electricity in the classrooms. The room used for testing was unusual in having windows on three sides which were above eye level--designed perhaps to provide good ventilation and discourage visual distraction from outside. There were no pictorial stimuli in the classroom itself. The pupils and teachers indicated relatively frequent contact with film shows--once a month or so. Both Standard 7 streams were tested in the afternoon.

Mwembe Songo Primary School. A large primary school located within a residential area of typical Tanzanian urban houses (multi-family, courtyard, some with electricity), Mwembe Songo has a spacious campus setting for the various classroom blocks. The comparatively new classroom used for the testing did not have electricity. There were various posters in the classroom.

As the experimentation continued in the various schools, I was curious to see if it was possible to discern any intuitive sense of variation to the testing from school to school. There was little opportunity to observe the ongoing academic program which meant that contact was limited to informal conversations and interludes with teachers and pupils. Mwembe Songo's two Standard 7 classes did well on the tests but it was impossible for me to predict the outcome based on the impressions gained from visiting the school. Except for Usangi Girls Primary School where low achievement on the tests would have been a surprise, I found that all the variations in physical plant, amount of pictorial material, and the nature of the immediate surroundings were not particularly useful cues for predicting the outcome of each school's results. Table 30 summarizes the findings on a class and school basis.

Most of the pupils at Mwembe Songo are from the Waluguru community. Testing was conducted in the morning.

Melela Primary School. Noted for its successful efforts in self-reliance through all-school farming activities, Melela Primary School is situated off the main road between Morogoro and Iringa, approximately 12 miles (19 km) southwest of Morogoro in rolling, dry (except during the rains) plains. While not isolated, few of the pupils have had much contact with the town and on that basis it was classified with more remote schools. Film shows are uncommon in the area. There has been some contact in the past with the teachers college at Morogoro so that one of the lower standards was experiencing the discovery process in science. However, the Standard 6 and 7 classes had been exposed only to traditional teaching. There were maps and posters in the classroom used for testing. Both of the classes were small--with the explanation for less than 30 in the classes (vs. the average size of 39) unclear. The school is in the Waluguru traditional area. Testing was conducted in the morning.

Mikese Primary School. The location of Mikese school may be a key to explaining why the Standard 6 and 7 classes were highly successful in completing the study's task: It is about 11 miles (18 km) east of Morogoro town between the new and old roads to Dar es Salaam and a short walk from the Central Line of the nation's railroad system. It was classified as a rural school with access to a town and had a high percentage of pupils who have lived in a town. While the teacher apologized about the pupils' facility with Swahili, I noted that they worked fast in completing the test. There were few pictorial stimuli in the classroom although another one for lower standard pupils had various charts of Swahili vocabulary which had been illustrated by the teacher. Perhaps contact with the excellent Morogoro Teachers College had been made here too. The pupils were primarily Waluguru. Testing was conducted during the afternoon. Some pupils had seen films shown recently in the local area by workers on the Tanzania-Zambia railway.

Summary

The regions which hosted the study are generally above average in their development compared to other regions of Tanzania. Their road and communication networks were often superior to others. The schools were selected by the Regional Education Officers after a discussion about the study's aims and the kinds of schools appropriate for the study. Any generalization to pupils in Standards 6 and 7 in the regions tested must be made cautiously from a statistical point of view, and cannot be made to the rest of the nation at all.

However, practical generalizations can be offered which make the assumption that the schools in the study would be typical or slightly above many of the other primary schools. In the interests of scientific rigor, generalizations to the population based on these 16 schools are not made here. Instead, those familiar with the schools of Tanzania may wish to use the background information of this appendix and formulate their own conclusions. For policy makers and for practical purposes in the absence of contradictory information and data, it is my opinion that this is a legitimate use of the study's data--with the disclaimer that there are restrictions on the filmic stimuli's general qualities (especially the short duration of the stimulus materials and the very familiar subject matter). In the interests of allowing full scrutiny of the schools and classes, the following table summarizes the individual test data used in generating the results of the study.

TABLE 30

School and Class Data

School	Cell No.[a]	N	Test $\overline{X}$	S.D.	Sex		Age $\overline{X}$ (Years)	Viewing $\overline{X}$ (Category)	Town Experience	
					M	F			w/	w/o
Arusha Region										
Uhuru		89	66.15	9.20	54	35	13.8	2.76	89	0
Class 7c	3	47	70.32	5.41	24	23	14.3	2.77	47	0
Class 7b	25	42	60.81	9.66	30	12	13.2	2.76	42	0
Naura		90	62.84	8.99	39	51	13.3	2.72	90	0
Class 6	10	43	58.30	7.99	20	23	12.7	2.63	43	0
Class 7	20	47	67.00	7.81	19	28	13.9	2.80	47	0
Daudi		73	64.40	7.27	56	17	15.4	1.45	0	73
Class 6	16	40	65.25	6.17	35	5	15.0	1.48	0	40
Class 7	22	33	63.36	8.41	21	12	15.9	1.42	0	33
Madunga		70	66.44	8.03	45	25	14.9	1.19	0	70
Class 6	5	31	62.07	9.96	19	12	13.9	1.06	0	31
Class 7	31	39	69.92	3.30	26	13	15.7	1.28	0	39

TABLE 30--Continued

School	Cell No.[a]	N	Test $\overline{X}$	S.D.	Sex		Age $\overline{X}$ (Years)	Viewing $\overline{X}$ (Category)	Town Experience	
					M	F			w/	w/o
Coast Region										
Mnazi Mmoja		128	69.00	9.58	71	57	14.2	2.80	128	0
Class 7b	11	43	68.35	11.13	23	20	14.3	2.60	43	0
Class 7c	18	42	68.41	9.82	22	20	14.3	2.83	42	0
Class 7a	28	43	70.23	7.57	26	17	14.0	2.98	43	0
Msasani		87	67.82	8.97	46	41	13.8	2.74	87	0
Class 6	2	43	62.63	9.22	18	25	13.3	2.51	43	0
Class 7	27	44	72.87	4.95	28	16	14.3	2.95	44	0
Mjimwema		27	67.74	7.72	12	15	14.4	1.93	15	12
Class 6	23	27	67.74	7.72	12	15	14.4	1.93	15	12
Vikindu		146	69.55	6.34	130	16	15.4	2.29	84	62
Class 6b	13	36	65.72	8.46	29	7	15.2	2.22	16	20
Class 6a	24	29	70.38	4.40	23	6	14.3	2.31	19	10
Class 7a	8	41	72.12	4.52	39	2	16.0	2.29	24	17
Class 7b	29	40	69.78	5.41	39	1	16.0	2.33	25	15

TABLE 30--Continued

School	Cell No.[a]	N	Test $\overline{X}$	S.D.	Sex		Age $\overline{X}$ (Years)	Viewing $\overline{X}$ (Category)	Town Experience	
					M	F			w/	w/o
				Morogoro Region						
Msamvu		96	65.33	6.95	96	0	15.0	2.42	96	0
Class 7	1	46	69.11	4.64	46	0	15.2	2.50	46	0
Class 7	26	50	61.86	6.95	50	0	14.8	2.34	50	0
Mwembe Songo		89	73.07	3.90	58	31	14.9	3.03	89	0
Class 7b	12	44	71.55	4.25	30	14	15.0	3.16	44	0
Class 7a	19	45	74.56	2.86	28	17	14.7	2.91	45	0
Melela		46	66.52	7.78	33	13	15.4	1.89	7	39
Class 6	14	27	64.48	7.32	19	8	14.8	2.00	3	24
Class 7	21	19	69.42	7.66	14	5	16.3	1.74	4	15
Mikese		58	72.07	4.51	45	13	15.2	2.22	23	35
Class 6	32	29	70.69	5.05	21	8	14.6	2.10	14	15
Class 7	15	29	73.45	3.45	24	5	15.8	2.34	9	20

TABLE 30--Continued

School	Cell No.[a]	N	Text $\overline{X}$	S.D.	Sex M	Sex F	Age $\overline{X}$ (Years)	Viewing $\overline{X}$ (Category)	Town Experience w/	Town Experience w/o
Kilimanjaro Region										
Majengo		42	69.45	5.82	25	17	13.8	3.14	42	0
Class 7b	4	42	69.45	5.82	25	17	13.8	3.14	42	0
Jamhuri		94	69.32	5.12	53	41	14.2	3.35	94	0
Class 6	9	48	68.85	5.45	23	25	13.5	3.17	48	0
Class 7	17	46	69.80	4.77	30	16	15.0	3.54	46	0
Mengwe		86	62.58	8.73	54	22	15.6	1.73	1	85
Class 7a	6	54	63.26	9.83	46	8	15.8	1.70	1	53
Class 7b	30	32	61.44	6.44	18	14	15.3	1.78	0	32
Usangi		46	72.43	3.51	0	46	13.4	2.28	15	31
Class 7a	7	46	72.43	3.51	0	46	13.4	2.28	15	31

[a] Cell No. refers to treatment layout:

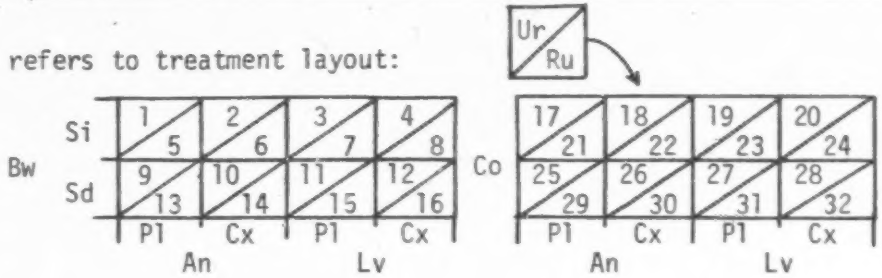
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PLATE I. REPRESENTATIVE SCHOOLS (1)

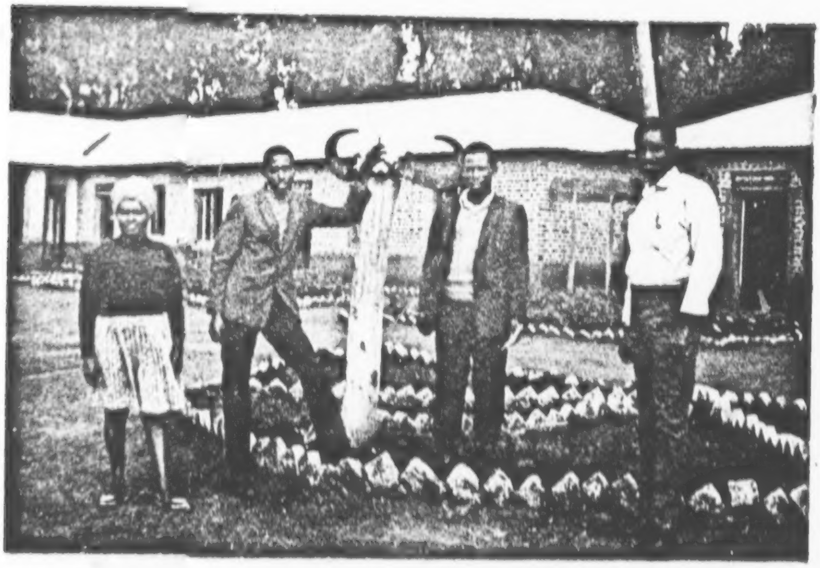


Figure 18. Arusha Region: Madunga Primary School. Head teacher Mr. Peter Dahaye is second from right. Note cool weather clothing and small windows in classrooms in background.

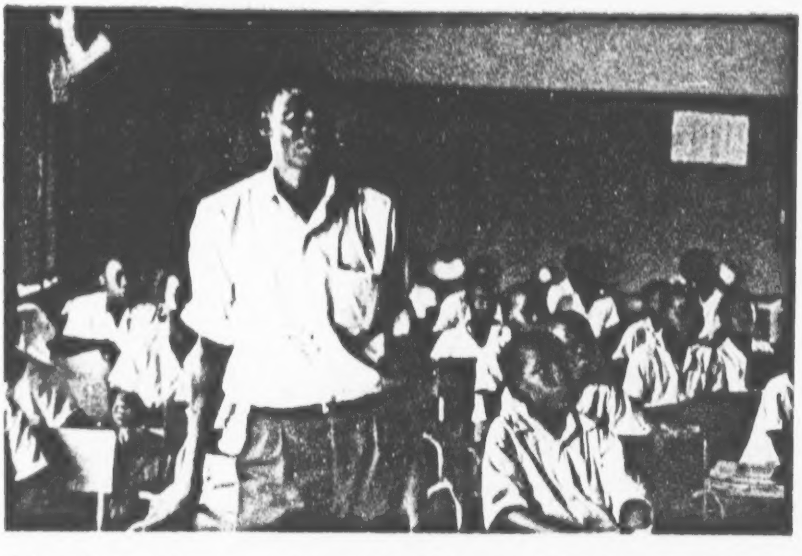


Figure 19. Coast Region: Msasani Primary School. Assistant head teacher Mr. R. R. Hizza and pupils are viewing the films shown after the testing. The windows are large; the surface at the rear of the classroom is intended as a bulletin board.

PLATE II. REPRESENTATIVE SCHOOLS (2)

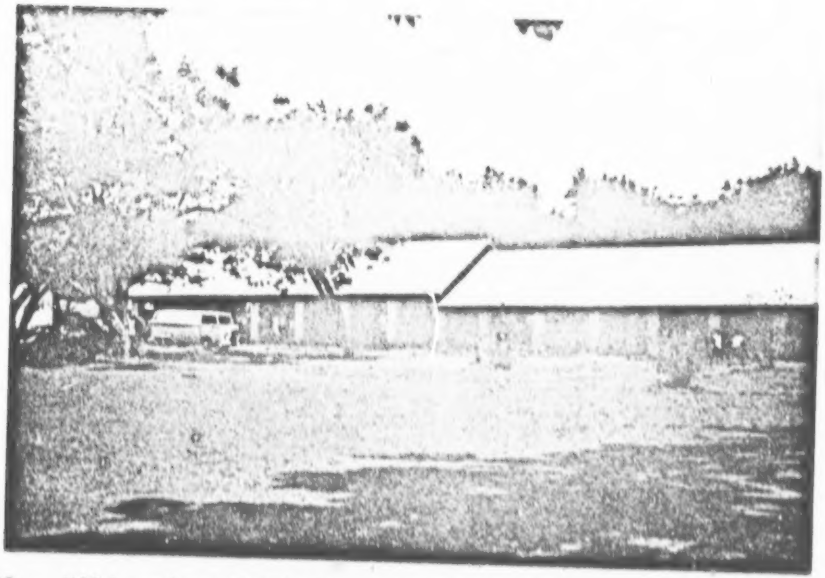


Figure 20. Kilimanjaro Region: Majengo Primary School. The large sloping roof covers an open corridor leading into the classrooms and shades the door and windows from direct sunlight during school hours. The trees provide additional shade. Obscured by the clouds in the background is Mt. Kilimanjaro. Head teacher is Mr. John Jordan.

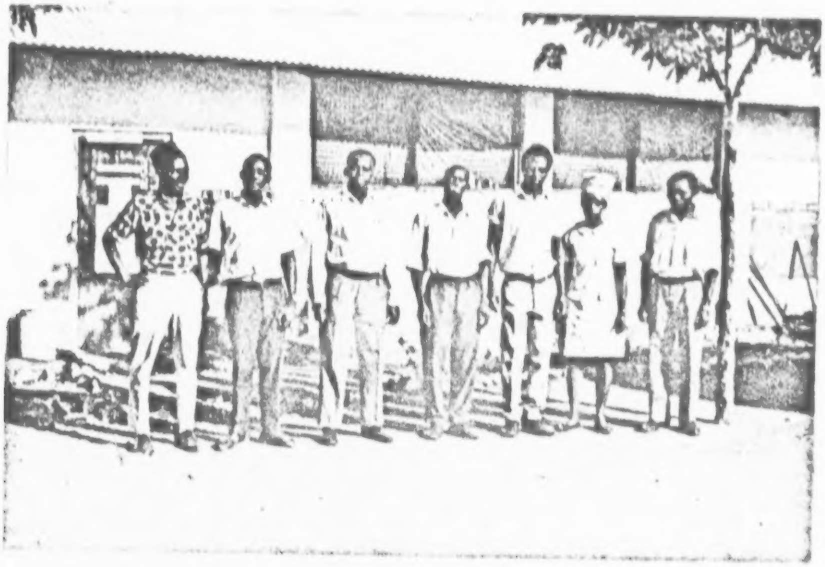


Figure 21. Morogoro Region: Melela Primary School. Head teacher is Mr. Joseph Mhilu, third from left. The warm climate means larger windows and lighter clothing. Note plastic covering over windows receiving direct sunlight--a procedure used throughout the study.

Appendix 4

Super 8mm: Production and Projection

In the complex psychological world of professional photographers and cinematographers, a mystique is dying a slow death. The concept that taking the real photograph or making the real film is something like going to the moon appears to be going the way of the Speed Graphic and reel to reel tape recorders. Those chosen few who could master the jargon, f/stops and cumbersome equipment are now watching a new generation (including more and more women) using automatic exposure control cameras and wondering where it will all stop. The new photographic and cinematic technology originally aimed at the amateur market is now moving into younger professional hands. The jealous old professionals are seeing their once sacred territory opened up by market place economics supported by technology. Admittedly, the transition is chaotic, expensive and wasteful in the industrialized nations. My personal experience may be useful in explaining my reasons for irreverance to large format in still photography and cinematography.

As a budding young photojournalist, I quickly learned that the 4 x 5 Speed Graphic sheet film camera was expensive to feed with film and flash bulbs, heavy and awkward to carry, and demanded very accurate focus from an inaccurate focusing device to bring in sharp pictures. The old pros with their developer-stained hands and clothes clung to their trusty Speed Graphics as I quickly switched to a twin-lens reflex camera and then took the fateful step of buying a Nikon F 35mm camera in 1959. The reasons for moving to 35mm were clear--I got better pictures more easily for less money. The never-dependable flash cord could be packed away. Better films, lenses, and cameras were coming along in an avalanche as manufacturers vied for the expanding amateur market.

But the Speed Graphic had always separated the true professional from the Brownie-toting amateur and the world of the 35mm still camera for many of the oldtimers was regarded as amateur, even though the National Geographic had used Leica-made pictures for years. The mystique which holds that photography and cinematography must be hard physical work using special equipment and terminology beyond the reach of the inferior "amateur" still retards logical moves from 16mm to super 8mm. The logic for change to the small format is very strong--especially for nations whose film libraries and equipment, which have their origins in the colonial era, have long depreciated to zero value.

Since the logic is strong for cheaper, more flexible, lighter production and projection equipment, I tested the super 8mm format for all phases of my film research under field conditions in Tanzania. All the equipment used was available in Tanzania. The processing of original film stock was done in Kenya. The only use of services outside East Africa was in the making of color and black and white prints. The high gain Kodak Ektalite screen was sent especially to me from New York but became available later in East Africa. In other words, I relied upon equipment and services readily available in East Africa for nearly all of my film research needs. The total footage used was about 4,000 feet of super 8mm stock--roughly equivalent to 7,000 feet of 16mm or 5 hours of silent screen time.

To determine the practicality of using super 8mm for all phases of production and projection there are few better places in the world than Tanzania, and few more appropriate tasks in film research.

Equipment must be dependable, rugged, and portable since repair services are available but often hundreds of miles away and spare parts often reside in other continents.

Because my research grant's budget did not include money for purchasing equipment, I had to use my own funds and was in no position to lay out the large sums for even a 16mm projector--let alone camera, lenses, editing equipment and a 1.2 kilowatt portable generator. Instead, I chose a Canon 814 camera, a Eumig Mark 8 silent projector, a Honda 300U portable generator, an Erics editing viewer, Kodak splicer, small friction head tripod, and Kodak's Ektalite screen. A Toshiba Kt-20p cassette recorder was used for the recording and playback of the sound effects. To boost the sound level, the recorder's output went into a National Panasonic radio and then to an 8-inch speaker in the front of the classroom. With the costs of duty and shipping often doubling the price of the items, I felt lucky to have spent only about $1,200 for a new, good quality super 8mm system. A used 16mm Bell and Howell projector and a 1.2 kilowatt generator in good condition would have cost more.

The reader should appreciate that prices of photographic items and other goods not essential to basic living are taxed very heavily by governments in the developing world. They rely on import duties for the basic tax structure and to discourage the outflow of foreign exchange. Saving foreign exchange is often couched in patriotic terms. If 16mm color stock which must be air freighted to Europe or America can be replaced by locally processed super 8mm, black and white, the treasury minister is much more likely to accept films as a reasonable educational investment rather than an expensive luxury. My research was thrust in two directions--primarily to test filmic comprehension but also to test the use of super 8mm as a possible alternative to much more expensive 16mm production and projection.

After determining the needs for research into the filmic variables (black and white vs. color, animation vs. live action, silent vs. sound effects, plain vs. complex background), I selected the medium priced Canon 814 camera. It has an 8 to 1 zoom ratio, single frame facility, manual or automatic diaphram setting option, and a general high quality of workmanship.

Animation Techniques

The research design called for comparing animation with live action. This requirement automatically meant making subject matter and camera techniques as identical as possible for both filming modes. The relatively large screen of the editing viewer (about 4 x 6 inches or 10 x 15cm) allowed the live action frames to be traced directly onto tracing paper and then converted into the necessary acetate animation cels. My artistic experience was limited but this straight forward tracing and then simple inking and opaquing was within my limits. The five filmed actions were all repetitive--again part of the research design--and most could recycle after 30 frames or less.

Adaptations from normal animation procedures had to be made, of course. The cels were punched with a two-hole paper punch rather than an Oxberry or Acme punch. The frame counter was simply a hand counter attached to the single frame cable release.

I had to devise a way of panning with a bicycle rider. Since only the background was travelling, the real requirement was to make sure that the background's linear movement was smooth. I attached the long background sheet to a strip of soft wood and simply inked in the points I needed to indicate frames. A marker was put on another strip of wood attached to the base and laid flush with the background frame indicator. Both strips were lined up parallel and square with the camera and I shot the pan with only a little more discomfort than reading a Veeder counter. Anything more complex than a straight line pan would have been a different matter, however.

All of these animation techniques may sound crude and "amateur". Indeed they were by conventional standards. However, the costs of the animation were kept within reason; I maintained control over what was happening rather than sending everything to someone else in another continent; and the results were adequate in demonstrating that short simple animation sequences could be produced with available supplies in Tanzania using a good quality, general purpose super 8mm camera. (While it could do fades, the camera was not equipped for lap dissolves; I neither needed nor used either of those opticals.)

My use of super 8mm animation convinced me that titles, short full cel sequences, filmographs and puppets can all be animated with super 8mm equipment and that great cost reductions can be made by putting up with simply designed equipment and perhaps a little more patience than animation normally requires.

Prints from Super 8mm Originals

By a curious twist of fate, I was able to purchase abundant quantities of Kodak's super 8mm Ektachrome II in Tanzania and to have it processed in Nairobi, Kenya, by Kodak's laboratory. It was fate because this fine stock was made in Rochester, N.Y. but only sold outside of the United States. Ektachrome II has apparently been replaced by Ektachrome 40 which is inferior to Ektachrome II for duplication. In fact, the quality of the Ektachrome II duplicates was quite close to duplicates from 16mm Ektachrome EF. Color balance was reasonable and grain was acceptable.

Black and white prints were made from the color originals as part of the research design for comparing color with black and white. The latter was an unusual request and a small laboratory outside of New York City was able to fill the order for both color and black and white prints. Since the time the prints were made (September, 1970), many more American film labs have begun offering similar services. Optical services are now available also so that A and B rolls, color and exposure corrections, dissolves, freeze frames, and other laboratory services formerly only available in 16 or 35mm can now be done in super 8mm.

Power for the Projector

Just as filmmaking is a form of art and technology unto itself, so is film projecting a separate craft and technology. The craft comes from being able to assemble the right kinds of equipment to put a picture on the screen and keep the projector functioning. I had originally intended to avoid the use of a noise producing, expensive generator or special alternator using a vehicle's engine for the necessary power for the projector. The power consumption of super 8mm projectors is approximately 20% of a 16mm projector (175 watts vs. 850 watts or more). I felt it might be possible to use a car battery as the power source for a super 8mm projector. The necessary device for changing 12 volts of direct current to 240 volts of alternating current (Tanzania's standard voltage) is a power inverter. These inverters are now popular with Americans owning camper-trailers, and a wide range of models is available.

I selected the Eumig Mark 8 projector because it produced a bright, sharp image with a 12 volt, 100 watt quartz lamp using an f/1.6 18mm to 30mm zoom lens. The strategy called for wiring the lamp so that it could go directly to the 12 volt battery, and then using the transistorized power interter for only the motor. This would reduce the load on the inverter and it would run more efficiently. I had not anticipated one phenomenon: the inverter's alternating current output is a rather ragged square wave while the projector motors are nearly always the shaded-pole type. It is not necessary to describe these motors in technical detail, other than to note that they require a smooth sine wave in order to operate efficiently. Otherwise they simply refuse to run normally, if at all. In short, the motor would not run using the battery-inverter combination.

There are capacitor and coil devices which can smooth out the square wave to approximate the sine wave and thus aid the shaded-pole motor to operate efficiently but there is considerable dissipation of energy when using such devices. A simple solution would be to substitute a 12 volt, DC motor for the shaded-pole AC motor. This substitution would involve redesigning the projector--an interesting task but beyond my talents or time in Tanzania.

The use of a 12 volt lamp and motor with a stepdown transformer and rectifier for normal mains use actually is more desirable than using an inverter to provide alternating current. This is because the all 12 volt projector would minimize battery consumption. Since nearly all vehicles are now being equipped with alternators rather than generators, battery recharging can be done easily and quickly if the films are shown from place to place. If there is a generator in the school or institution which runs only a few hours each evening, the battery can be recharged by a small charger. I have seen oblique references to 12 volt film projectors but have no firm information about their existence or availability. Readers are encouraged to contact me about such projectors or other projection techniques c/o Program of Eastern African Studies, Syracuse University, Syracuse, N.Y., 13210, U.S.A.

Another possible solution to the battery charging problem for institutions located near a regular bus or truck route is to buy two batteries and arrange for a bus or truck to recharge the battery during its daily run. Devices are available which allow switching from one battery to another automatically after one has been charged. Most vehicle owners would be glad to have an extra source of power. Indeed, any financial arrangement should be to the advantage of the projector's owner.

Having failed to find a quiet, inexpensive projection system, I was forced to use a Honda 300U portable generator to provide power. The transistor tape recorder and radio-amplifier I was using were powered by flashlight cells so that they presented no power requirements during research in the field. The generator provided either

12 volts DC--a portable battery charger--or 240 volts AC at an adjustable and metered 50 or 60 cycles, 300 watts. It was reliable, comparatively quiet some 20 meters away, and compact. A liter's filling of gasoline would provide about five hours of power. If I had used 16mm, I would have required either major modification of my Volkswagen van's engine to accept a large alternator and run the engine during the research or a 1.2 kilowatt generator. Either choice would have meant heavy expenses.

In retrospect, the small generator was a reasonable solution to the power problem for me. And it is the most sensible in cases where battery charging might prove difficult or impossible. Even readers familiar with East Africa might be surprised to note that half of the urban primary schools visited did not have electricity in many of the classrooms--although the schools were in towns which had had central power distribution for many years. The difficulties of film projection in areas without electricity are made simpler by super 8mm but certainly not overcome.

Projection in the Classroom

The film research could not have been carried out as easily without the Kodak Ektalite screen. The screen's surface is a specially prepared aluminum foil on a fiberglass base which reflects the projector's light in a very efficient way. It rejects light from the side and top through a concave design. The screen's dimensions of 40 x 40 inches (1 x 1 meter) were adequate for the 20 x 30 foot (6.1 x 9.5 meters) classrooms. The pupils were asked to look at and write down a numeral appearing on the screen before the actual testing.

As noted in Chapter 3, this numeral was the test's number and its screen size was approximately the size of the smallest detail required for accurate viewing. There were only several isolated cases of misreading this numeral and these were not used in the final sample of 1,267 pupils.

A different problem did arise as a result of the screen's sharp fall-off on the sides. The seats on the sides of the classrooms were usually moved towards the center--particularly those in the front of the classroom. Data were gathered on the pupil's position in the classroom on the basis of rows and columns. In some classrooms where long benches were used it was not possible to get adequate precision for this grid arrangement.

Of the final sample, 80 pupils (6% of the total) in 13 of the 16 classrooms used for testing were identified as possibly sitting in a marginal viewing condition, i.e. front row and to the sides. While their mean score was significantly below the overall mean score and their variance was greater (Table 31), they appeared to be a different distribution from the overall sample. They were the younger pupils, more often male, and saw fewer films. From the data, it is difficult to state a conclusive cause-effect relationship between seating position and score but undoubtedly some of the pupils sitting in the extreme positions were handicapped by decreased clarity of the screen image.

In some classrooms, direct sunlight was entering the windows. In those situations, dark green semi-opaque plastic curtains were placed over the windows admitting light which might affect the quality of the projected image.

TABLE 31

Data for Pupils Seated in Marginal Viewing Positions

	N	Test $\overline{X}$	S.D.
Overall Sample	80	65.28	10.19
Sex			
Male	56	64.61	9.64
Female	24	66.83	11.45
Age (Mean = 14.2 years)			
11-12	9	65.78	10.43
13	25	64.56	10.55
14	17	69.47	10.99
15	13	62.85	8.96
16	8	63.25	7.78
17-18-19	8	64.00	11.40
Viewing (Mean = 2.35 category)			
1	16	62.13	10.83
2	39	67.13	8.33
3	6	65.67	14.72
4	19	64.00	11.56
Town Experience			
Without town	22	63.41	7.41
With town	58	65.98	11.04
Education			
6	27	64.78	9.12
7	53	65.53	10.77

The position of the screen was the same in all of the classrooms: in the center of the front wall with the bottom edge a few centimeters above the eye level of the pupils (Figure 31). This position allowed the screen to tip forward as the manufacturer's instructions call for.

While the screen's surface is highly susceptible to fingerprints and scratches, only a few marks were picked up during the three months of intense travel and usage. The pupils were highly respectful of the equipment and did not touch the screen. I kept a bottle of lens cleaner ready for any eventuality but it was not needed. The original cardboard packing box was used for storage and transport after being covered with a contact adhesive-backed plastic film for strength and protection. The screen must be kept rigid and cannot be rolled or folded like ordinary screens. The manufacturer recommends permanent installation to prevent possible damage by handling but this investigator felt that the many advantages outweighed the awkwardness of a rigid screen and its sensitive surface. Having provided a specific location for the screen in the van used for transporting of equipment, it was not difficult to carry from school to school.

A second model of the Ektalite screen has come out which has a metal frame rather than the thick styrofoam framing of the first model. The new design is definitely inferior since the screen is now heavier and easily subject to dents being formed from the rear. Potential users are advised to attempt to obtain the first model or to some way protect the rear surface on the second model from dents. Another problem with the second model is the inability to positively lock the movable steel supporting rod which gives the necessary tilt to the screen. The solution to that problem depends on the conditions of use and apparently is left to the ingenuity of the user by Eastman Kodak's designers.

The rapid changes in film production and projection technology may make this discussion obsolete before many people read it. Hopefully, the changes will be ones which assist the developing nations to use films more economically. With the serious experimentation with super 8mm by television stations and networks in the United States, it may be that the impetus for change from 16mm will come from the television stations rather than from any rational analysis of conditions.

Institutions such as schools do not see themselves as bodies which can pass on obsolete but useable 16mm projectors to organizations which can use them for showing 16mm films to one or two thousand people. Hence headmasters retain old but servicable projectors and thus block the road to usage of new technology and locally made super 8mm films. The result supports the often cited maxim that it takes some twenty years for change to go from research to acceptance by the educational community. If that is the case here, then a great deal of money as well as a large opportunity for enrichment through films will have been lost.

PLATE III. ANIMATION PROCEDURES (1)

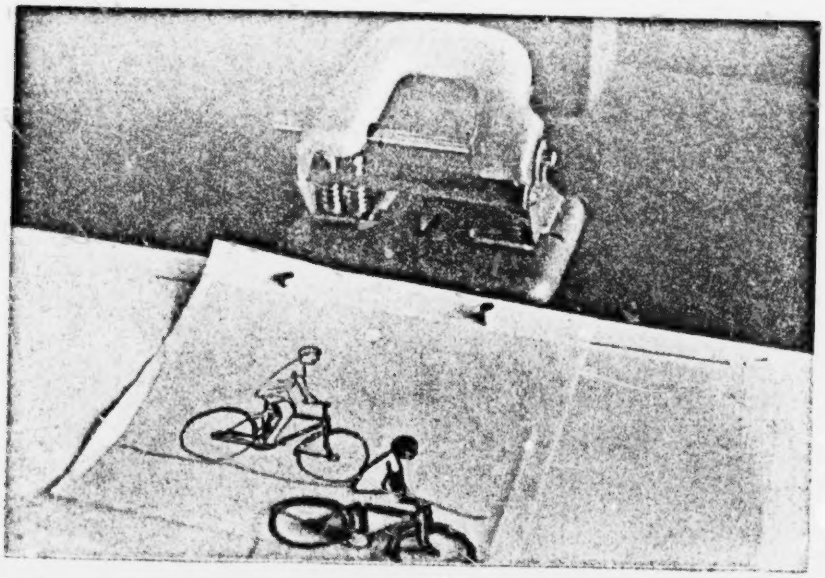


Figure 22. Cel punching. An ordinary two-hole paper punch was used for registration hole punching in the tracing paper and the acetate cels. Registration pins were made from large nails and covered with plastic tubing.

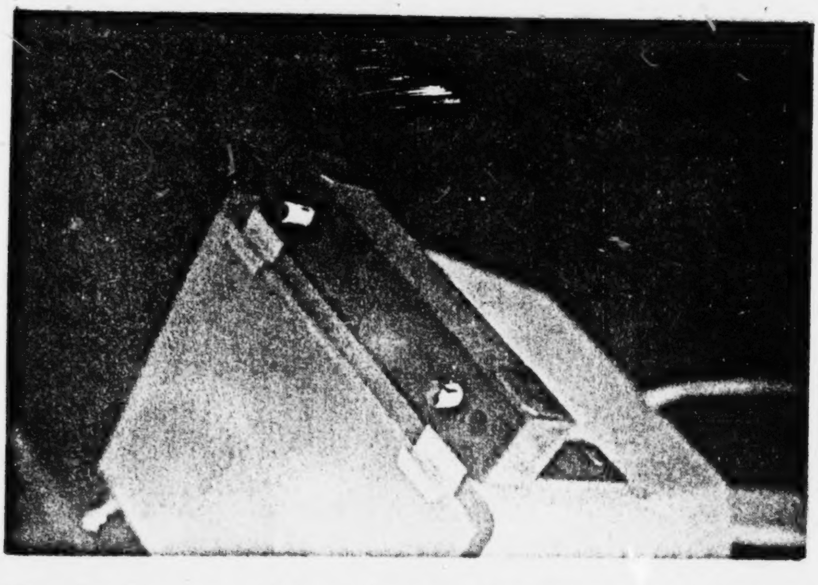


Figure 23. Peg bar on editing viewer. The hood of the viewer was removed and a crude peg bar was fitted to the viewer in a position which allowed the tracing paper to lie flat against the viewer's screen.

PLATE IV. ANIMATION PROCEDURES (2)

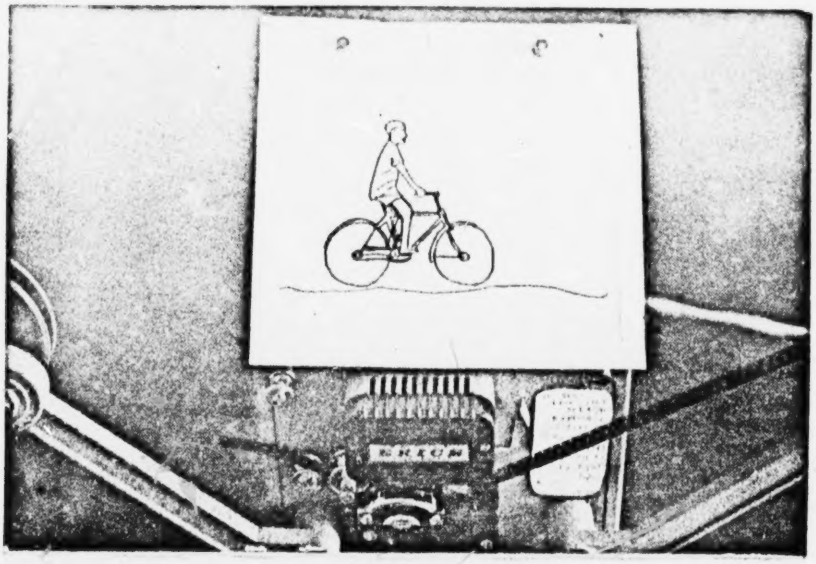


Figure 24. Tracing from live action footage. The animation drawings were traced from the live action frames using the modified editing viewer.

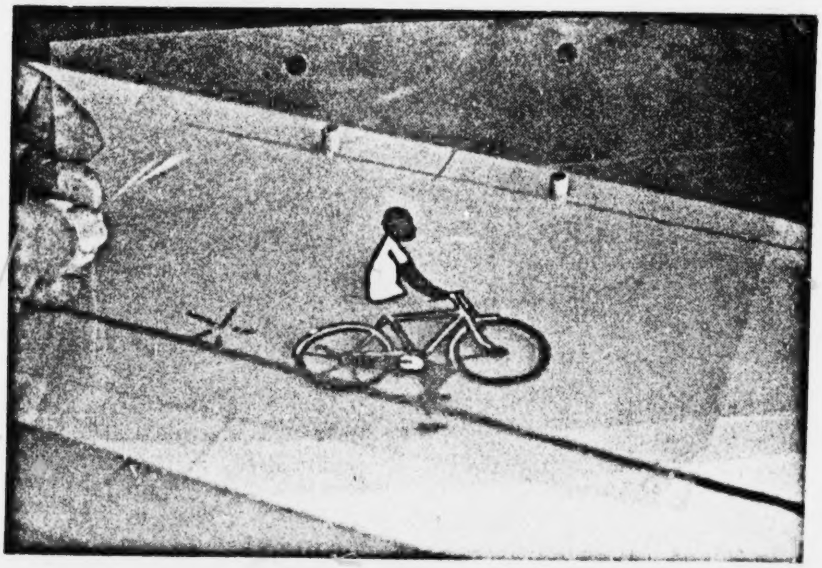


Figure 25. Several cel levels. Since the actions were repetitive, one cel served as the bicycle frame and cyclist's body. A second level provided the spoke and leg movement. The background moved in this panning shot.

PLATE V. ANIMATION PROCEDURES (3)

Figure 26. Completed cels. The background travelled to give the illusion of panning motion. The small marks represent frames. The background was moved by hand from mark to mark and the second cel level changed for the spoke and leg movement.

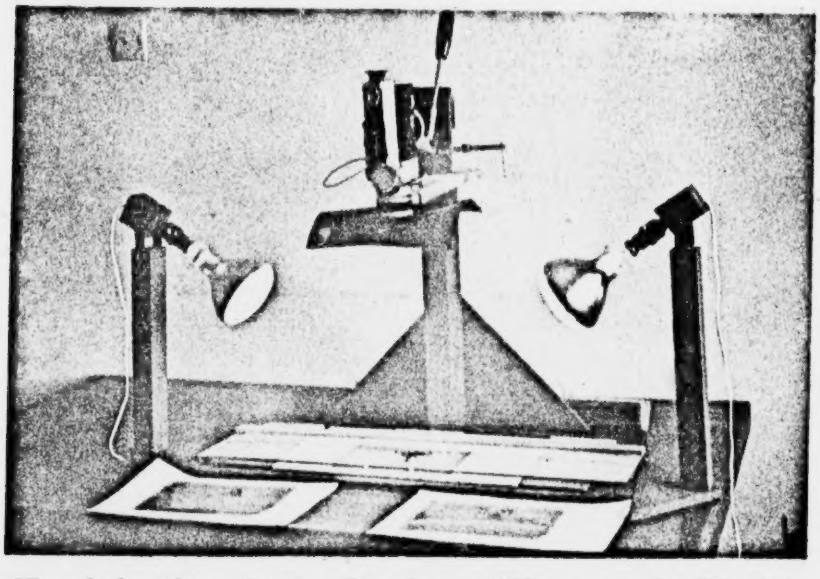


Figure 27. Animation stand. The Canon 814 camera is fixed in one position and equipped with a close-up lens, single frame cable release, and black paper reflecting shield. A long piece of glass from a louver window holds the material flat. Lights are ordinary 150 watt household flood lamps.

PLATE VI. ANIMATION PROCEDURES (4)

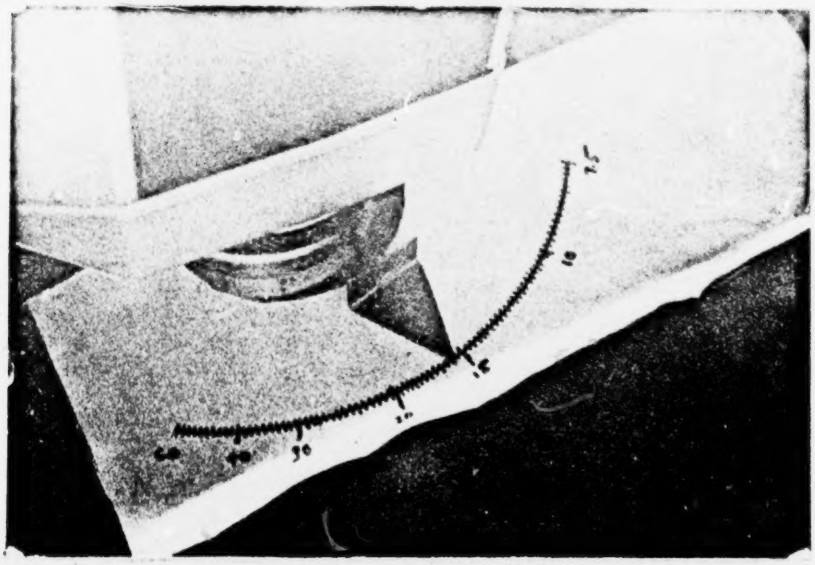


Figure 28. Zoom indicator. The zoom stick on the camera's lens was replaced by a pointer and extended. The marks represent frames over the 7.5 to 60mm zoom range. The position was changed manually for each frame.

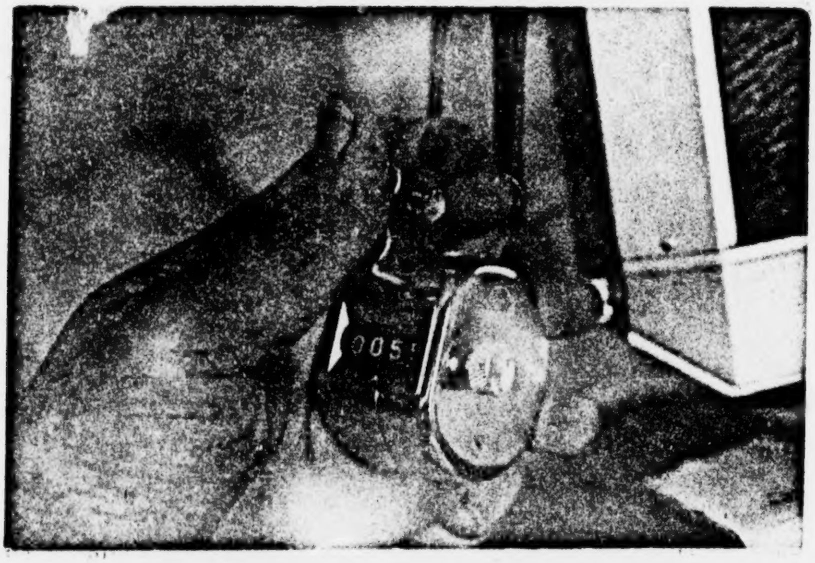


Figure 29. Hand counter. A hand counter was modified so that the thumb used for making the single frame exposure would also trigger the hand counter for accurate counting of the total frames for the shot.

PLATE VII. PROJECTION PROCEDURES (1)

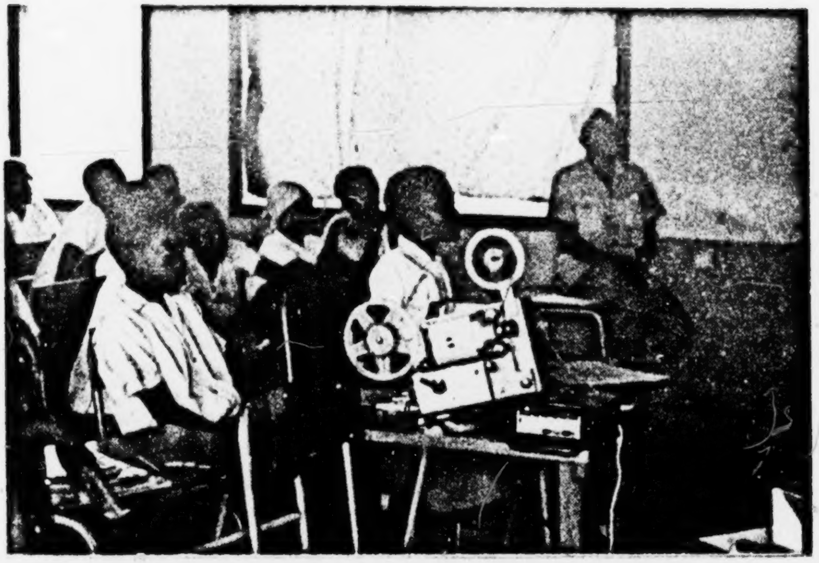


Figure 30. Projector in Msasani classroom. Projector, tape recorder, tape cassettes, and films were placed on small table at front of the classroom. Radio-amplifier was placed underneath table and loudspeaker was placed on teacher's table directly in front of screen. Semi-opaque covering over window cut direct light but allowed sufficient light for completing the experimental task.

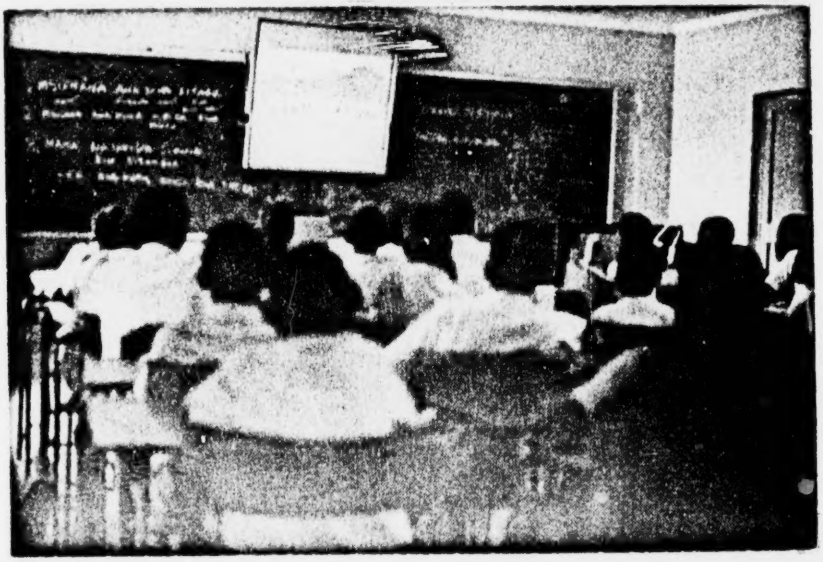


Figure 31. Screen position at Mengwe Upper Primary School. A nail used for holding maps was sufficient to hold the Ektalite screen in the proper position. Blackboard contains model answers for the task training examples. Pupils confused about the experimental task could easily refer to the form for answering "Who is doing what and using what object(s)?"

PLATE VIII. PROJECTION PROCEDURES (2)

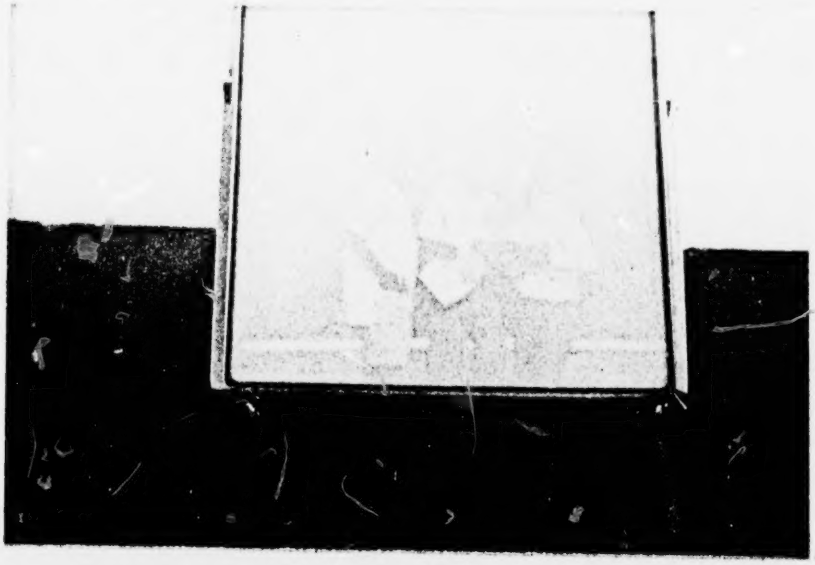


Figure 32. Screen stand. In those classrooms without a nail or hook for maps, and where it was inconvenient to drive a nail at the proper position, a stand was used to support the screen. It was merely three 1" x 1" sticks held together in an "H" by two clamps and leaned against the wall. The tips of the sticks were covered with inner tube rubber to increase friction. As specified by the manufacturer, the screen leaned forward from the bottom in order to reflect the projection light most efficiently.

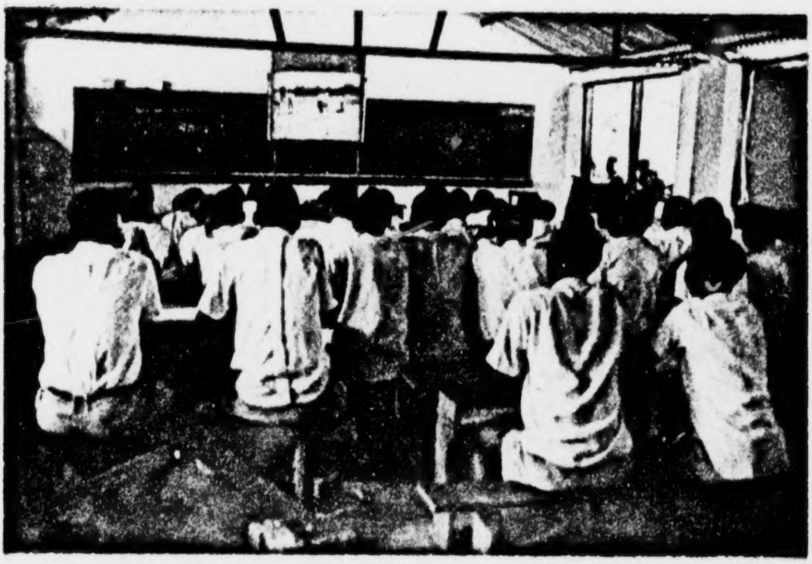


Figure 33. Screen position at Vikindu Primary School. The pupils' desks were moved to the center to maximize viewing conditions.

PLATE IX. PROJECTION PROCEDURES (3)

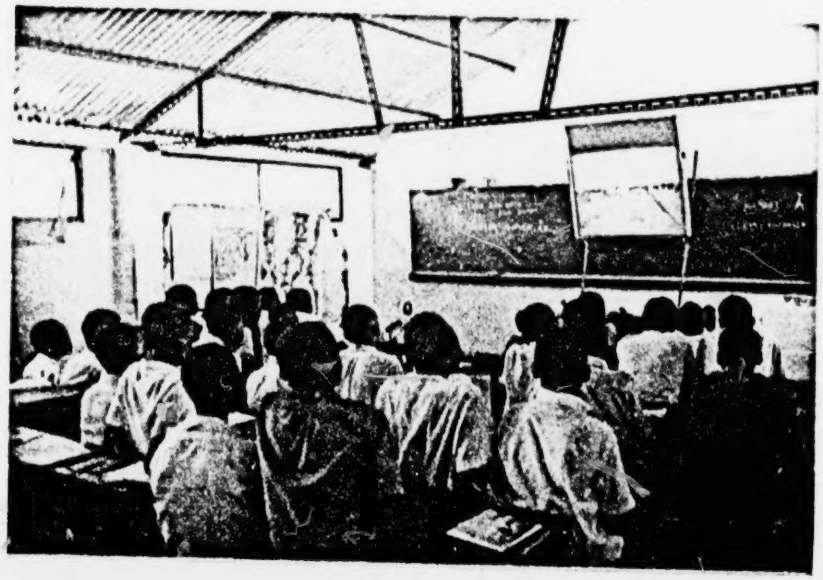


Figure 34. Side view of screen position at Vikindu Primary School. Photographs were taken during actual projection.

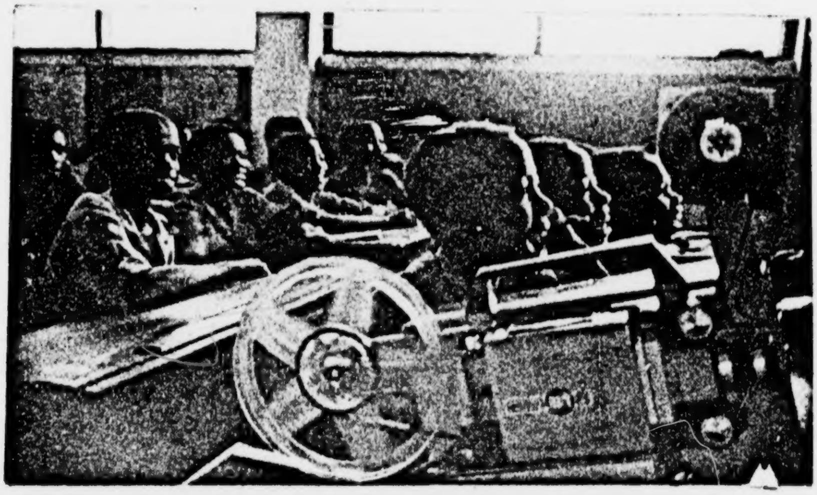
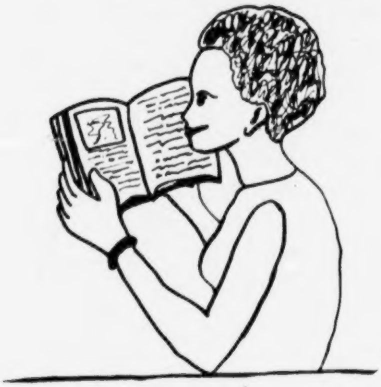


Figure 35. Reaction of pupils at Melela Primary School. This photograph clearly shows the intensity of interest and excitement of viewing the general interest films (soccer, track and field, large and small animals, Apollo 11 moon landing, etc.) shown by the investigator after the experimental task was completed. Few teachers operating in the conventional teaching situation can duplicate this reaction, which was observed in all of the schools visited. The teacher alone cannot bring into the classroom the vast amount and kind of information available on film. The reaction of the pupils to this form of gathering knowledge about the world is easily summed up in the picture above.

Appendix 5

Photographs of Task Training Examples and Stimulus Materials

PLATE X. TASK TRAINING EXAMPLES



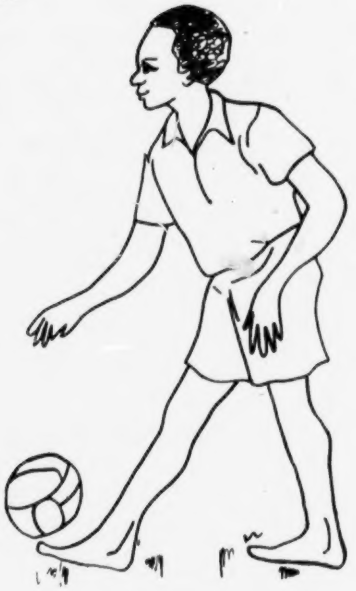
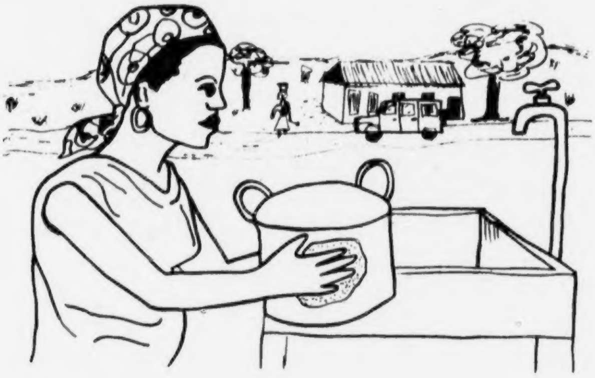


Figure 36. "A girl is reading a book."

Figure 37. "A young man is kicking a football (soccer ball)."

These examples were drawn by a Tanzanian artist and book illustrator, Mr. Elias Jengo. While they contain ambiguities, the purpose was to provide training in how to answer the broad question, "What do you see?", in a form which allowed a systematic scoring procedure and indicated to the investigator that the pupil was discriminating between one object and another, one action and another. (Photographically reduced from 21 x 35 inches--53.4 x 89 cm.)



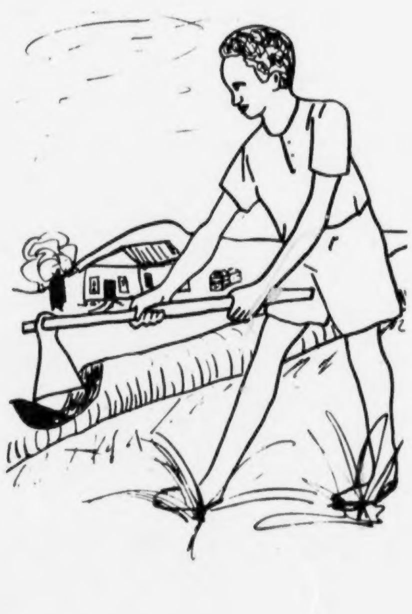


Figure 38. "A woman (or mother) is cleaning a pot with a cloth."

Figure 39. "A young man is cutting a log with an axe."

The following photographs (Plates XI to XVIII) were made from the original color super 8mm footage of the shots used in the study. The film was projected onto a matte surface; the projector stopped in the "stop motion" position, and the picture taken using a 105mm Nikkor lens on a Nikon F camera loaded with Tri-X film. The persistent dark band along the right side of the prints is a function of the projector used, as is the noticeable corner and edge distortion of the image. The projector used for producing these photographs (a Bell and Howell Autoload with a fixed focal length f1.6 lens) was not the one used throughout the field work and is quite inferior to the Eumig Mark 8 projector used in Tanzania.

The variation in density and contrast between some of the shots may have been reduced here in the attempt to provide tonal uniformity for reproduction of these plates for offset printing.

PLATE XI. ZOOM-IN (BEGINNING) AND ZOOM-OUT (END)

Hammering action

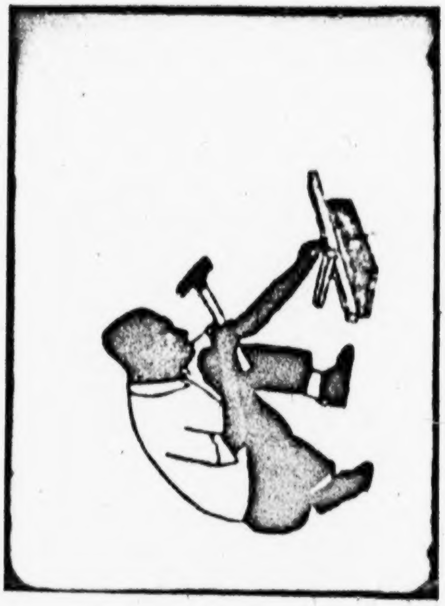


Fig. 40. Animation w/o background

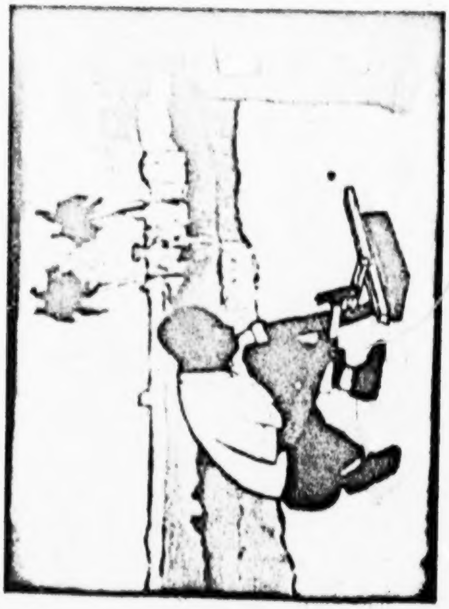


Fig. 41 Animation w/ background

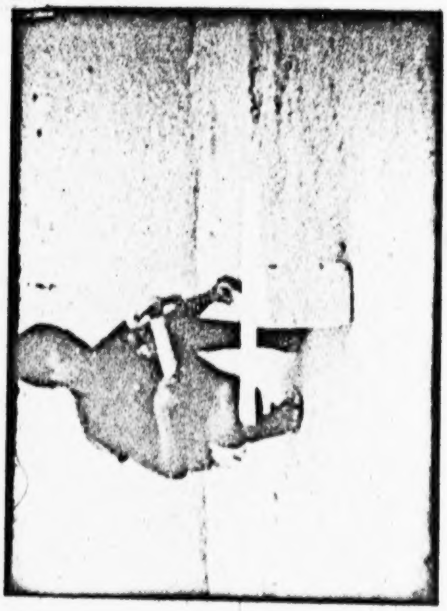


Fig. 42. Live action w/o background

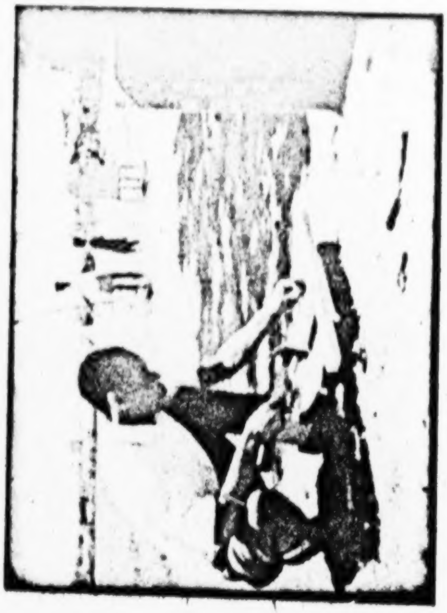


Fig. 43. Live action w/ background

PLATE XII. CLOSE-UP, ZOOM-IN (END), AND ZOOM-OUT (BEGINNING)

Hammering action

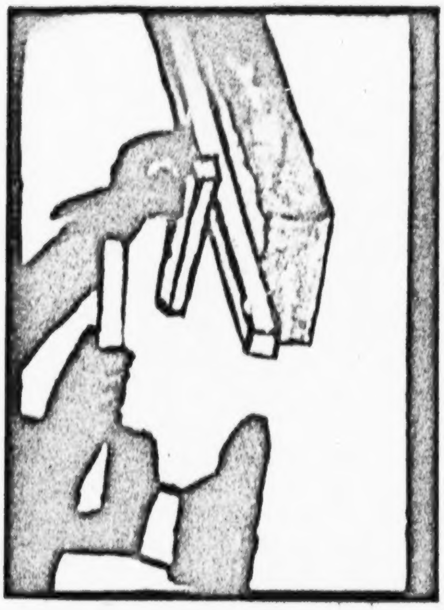


Fig. 44. Animation w/o background

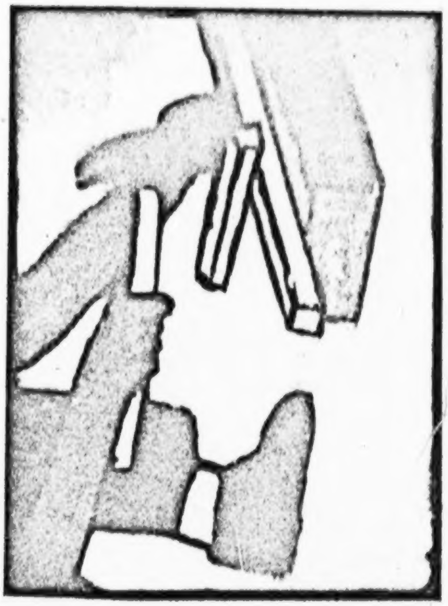


Fig. 45. Animation w/ background

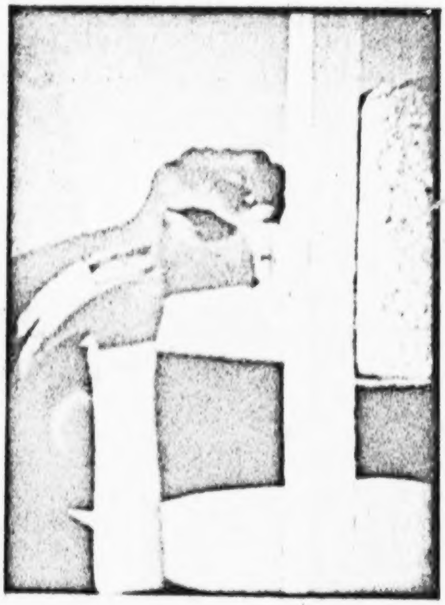


Fig. 46. Live action w/o background

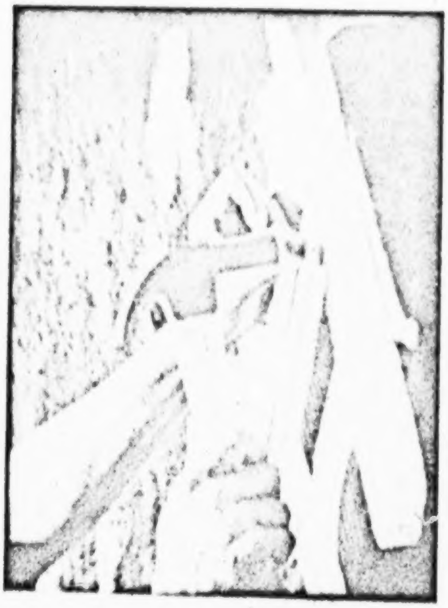


Fig. 47. Live action w/ background

PLATE XIII. TILT-DOWN (BEGINNING)

Sawing action

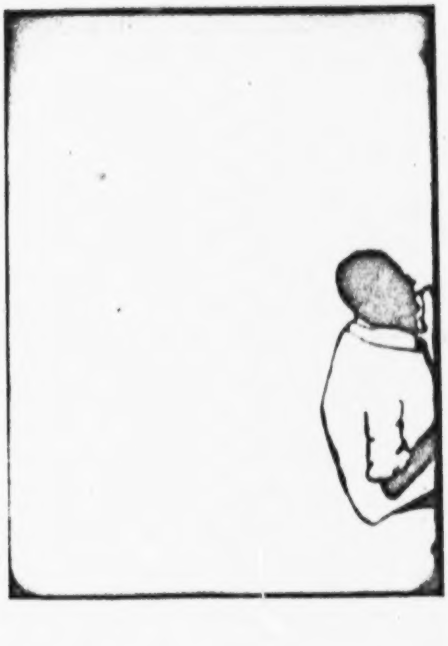


Fig. 48. Animation w/o background

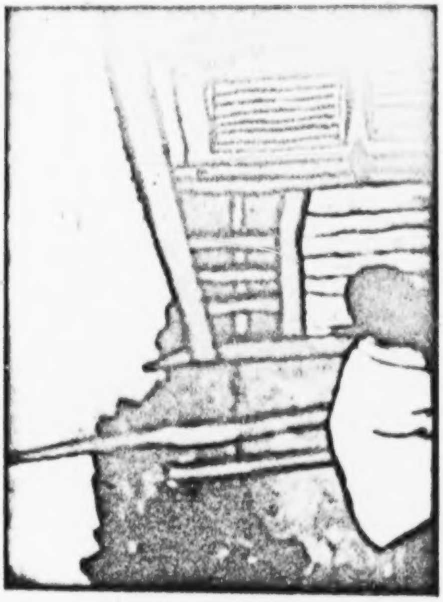


Fig. 49. Animation w/ background

Fig. 50. Live action w/o background

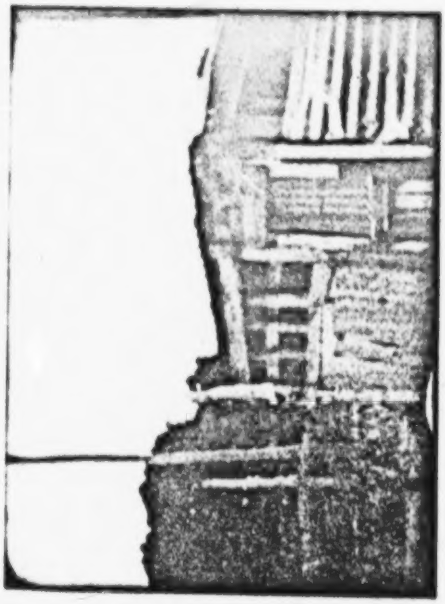


Fig. 51. Live action w/ background

PLATE XIV. TILT-UP (BEGINNING)

Sawing action

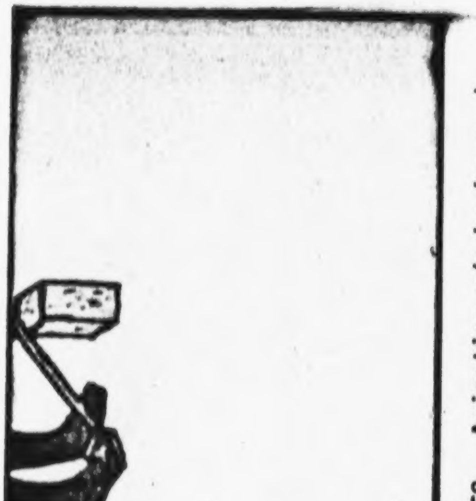


Fig. 52. Animation w/o background

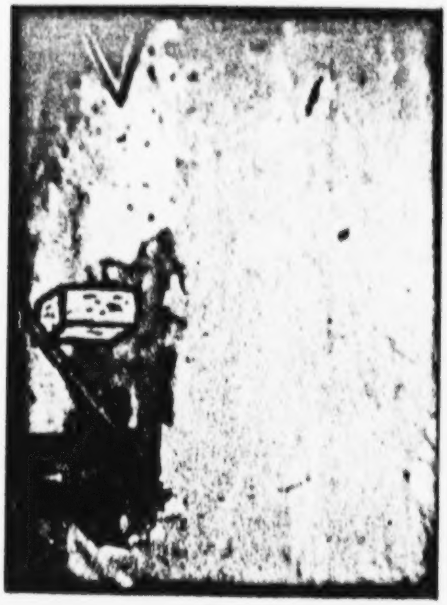


Fig. 53. Animation w/ background

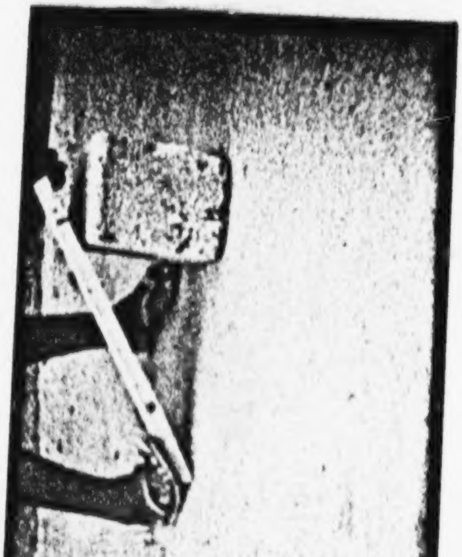


Fig. 54. Live action w/o background

Fig. 55. Live action w/ background

PLATE XV. MEDIUM SHOT, TILT-DOWN (END), AND TILT-UP (END)

Sawing action

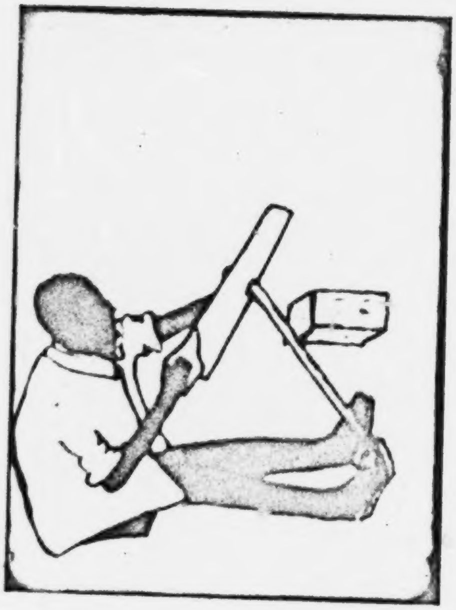


Fig. 56. Animation w/o background

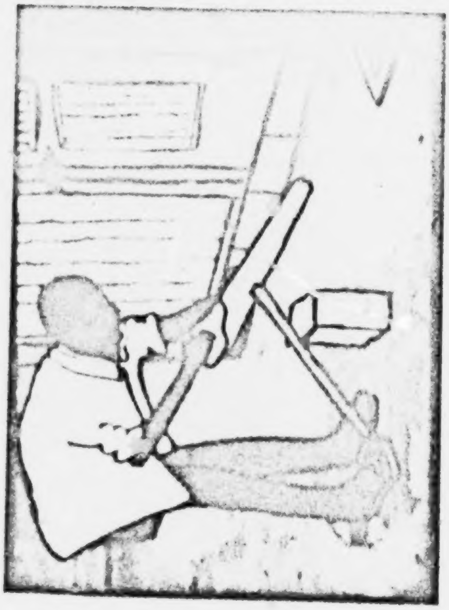


Fig. 57. Animation w/ background

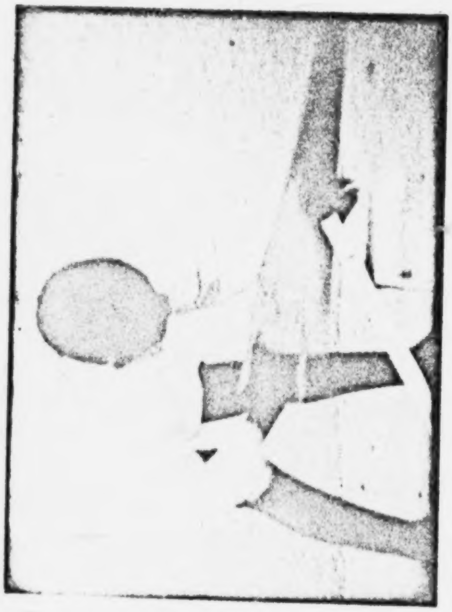


Fig. 58. Live action w/o background

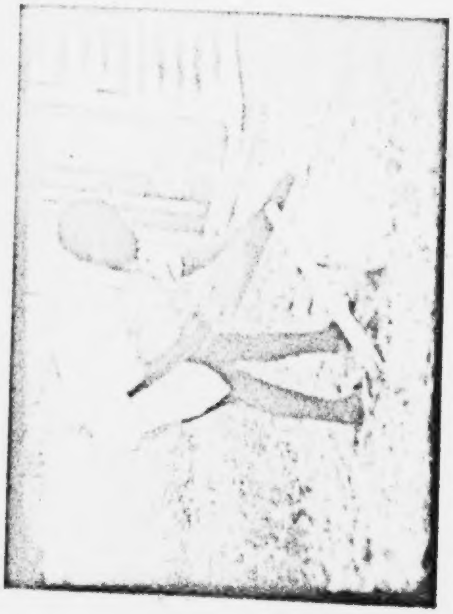


Fig. 59. Live action w/ background

PLATE XVI. PANNING SHOT

Bicycle action

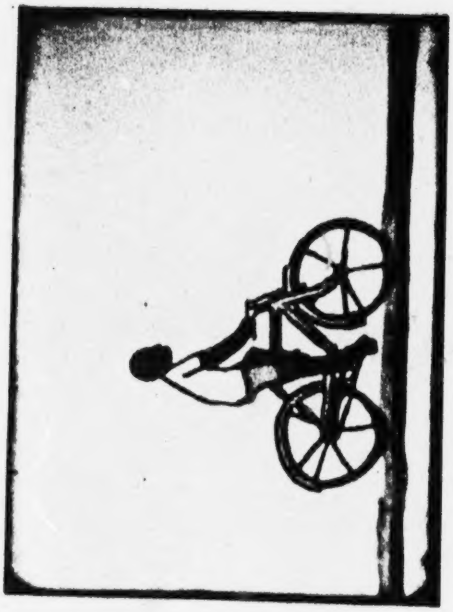


Fig. 60. Animation w/o background

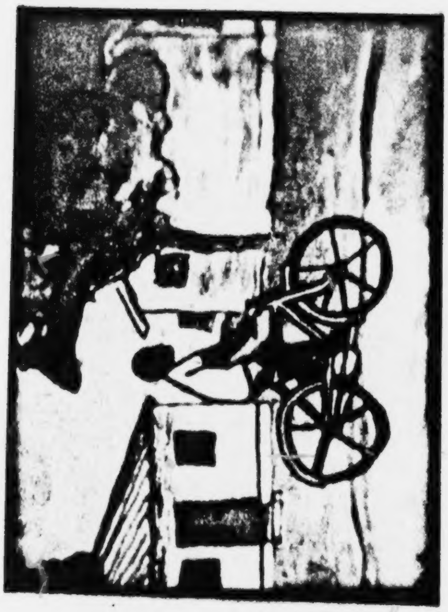


Fig. 61. Animation w/ background

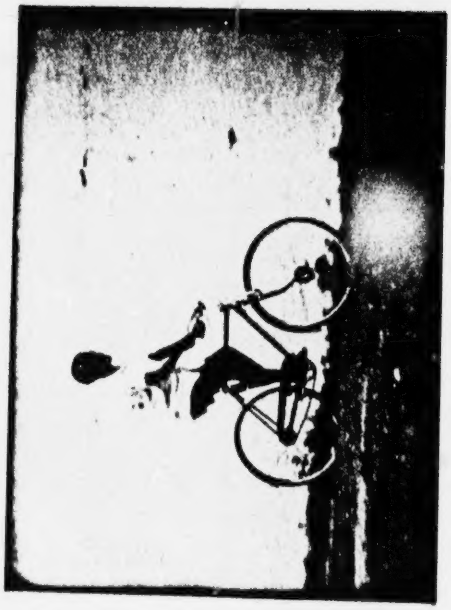


Fig. 62. Live action w/o background

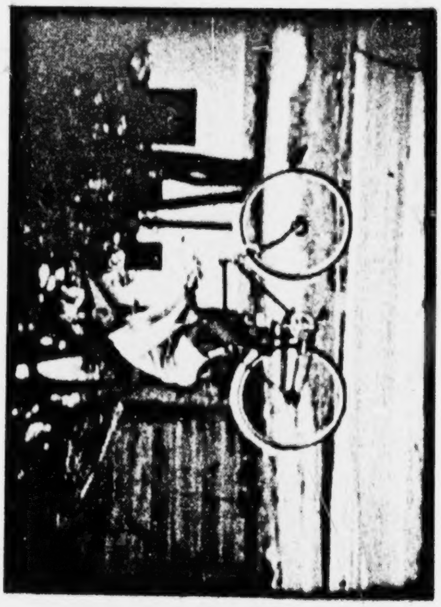


Fig. 63. Live action w/ background

PLATE XVII. LONG SHOT

Jembe action

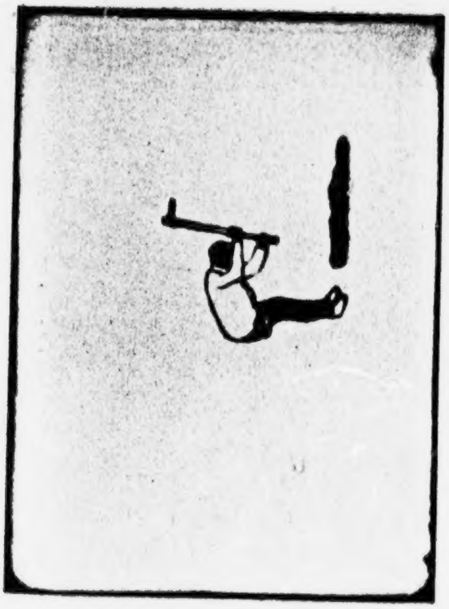


Fig. 64. Animation w/o background

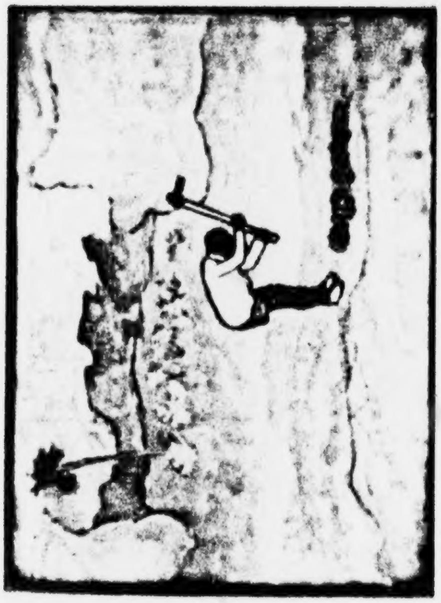


Fig. 65. Animation w/ background

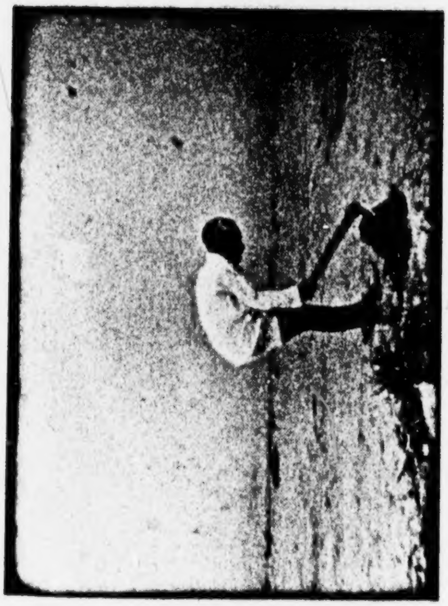


Fig. 66. Live action w/o background

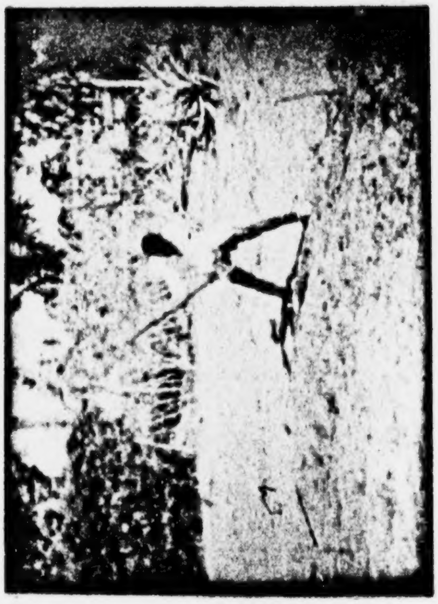


Fig. 67. Live action w/ background

PLATE XVIII. HIGH ANGLE AND SHORT DURATION

Sweeping action

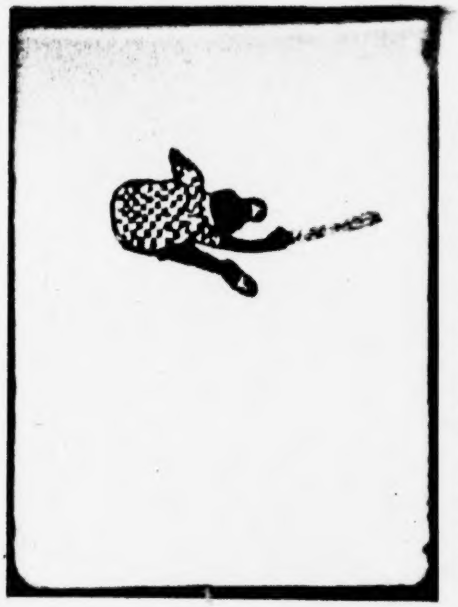


Fig. 68. Animation w/o background

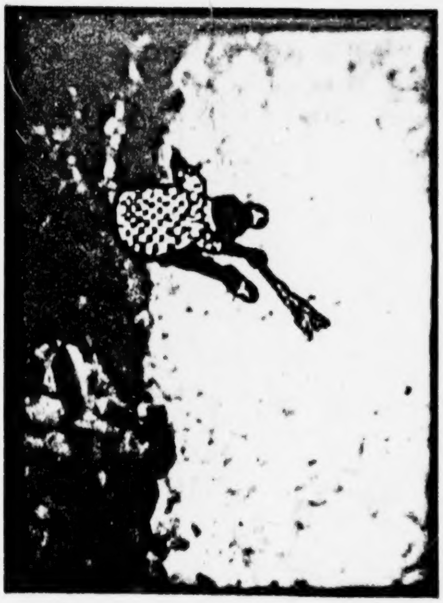


Fig. 69. Animation w/ background

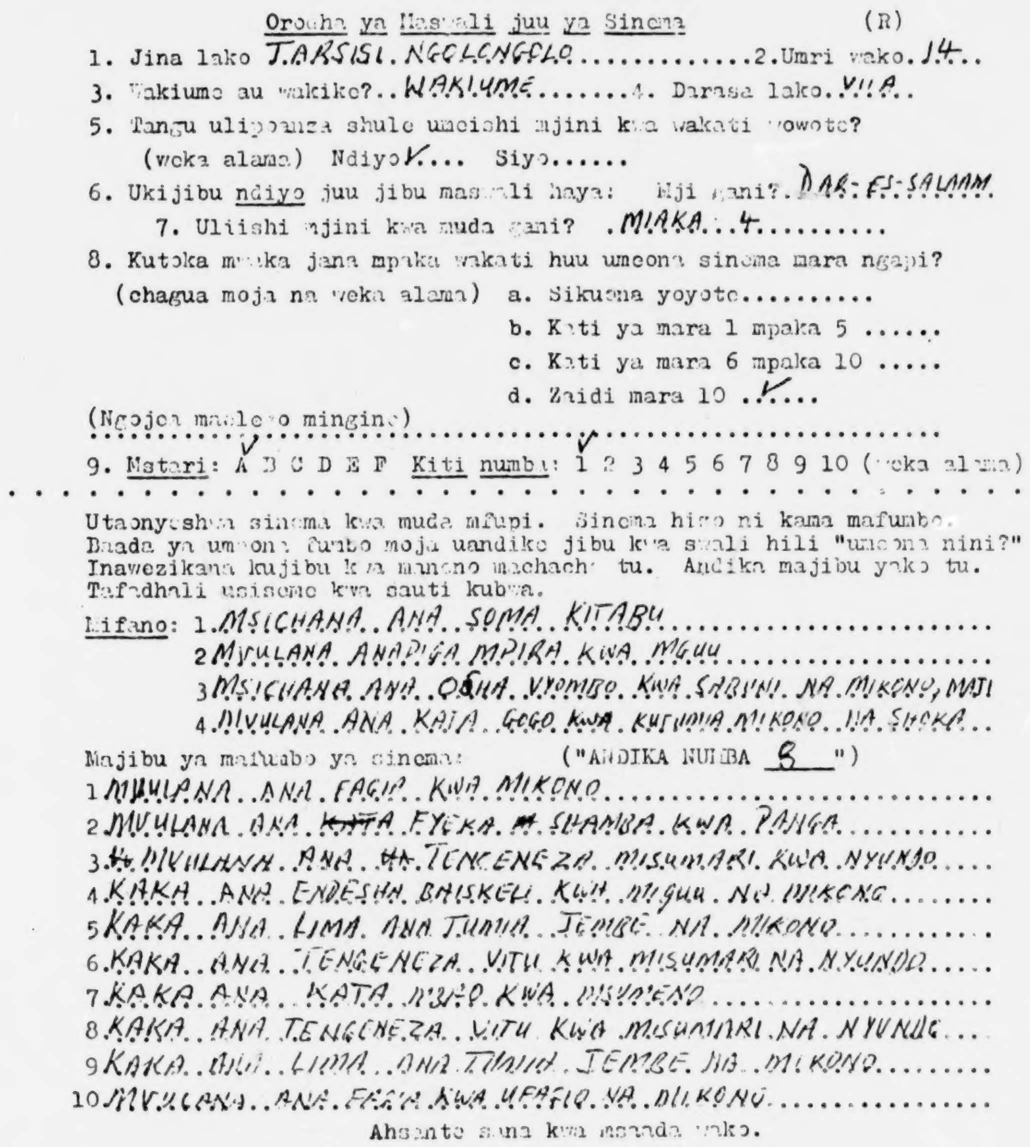
Fig. 70. Live action w/o background

Fig. 71. Live action w/ background

Appendix 6

Questionnaires and Response Scoring Procedures

Sample Questionnaire (Rural)



Orodha ya Maswali juu ya Sinema (R)

1. Jina lako T.ARSISI. NGOLONGOLO............. 2. Umri wako. 14..
3. Wakiume au wakike?.. WAKIUME....... 4. Darasa lako. VIIA..
5. Tangu ulipoanza shule umeishi mjini kwa wakati wowote?
(weka alama) Ndiyo ✓... Siyo......
6. Ukijibu ndiyo juu jibu maswali haya: Mji gani?. DAR-ES-SALAAM.
7. Uliishi mjini kwa muda gani? .MIAKA..4..........
8. Kutoka mwaka jana mpaka wakati huu umeona sinema mara ngapi?
(chagua moja na weka alama)
a. Sikuona yoyote..........
b. Kati ya mara 1 mpaka 5 ......
c. Kati ya mara 6 mpaka 10 .....
d. Zaidi mara 10 ..✓...

(Ngojea maelezo mingine)

9. Mstari: [✓ A] B C D E F Kiti numba: [✓ 1] 2 3 4 5 6 7 8 9 10 (weka alama)

Utaonyeshwa sinema kwa muda mfupi. Sinema hiyo ni kama mafumbo. Baada ya umeona fumbo moja uandike jibu kwa swali hili "umeona nini?" Inawezikana kujibu kwa maneno machache tu. Andika majibu yako tu. Tafadhali usiseme kwa sauti kubwa.

Mifano:
1. MSICHANA..ANA..SOMA..KITABU
2. MVULANA. ANAPIGA. MPIRA. KWA. MGUU
3. MSICHANA. ANA..OSHA. VYOMBO. KWA. SABUNI. NA. MIKONO, MAJI
4. MVULANA. ANA. KATA. GOGO. KWA. KUTUMIA. MIKONO. NA. SHOKA..

Majibu ya mafumbo ya sinema: ("ANDIKA NUMBA 8 ")

1. MVULANA..ANA.FAGIA..KWA.MIKONO
2. MVULANA.ANA.~~KATA~~.FYEKA.~~M~~.SHAMBA.KWA.PANGA
3. ~~M~~ MVULANA..ANA..~~M~~.TENGENEZA..MISUMARI.KWA.NYUNDO
4. KAKA..ANA.ENDESHA.BAISKELI.KWA.MIGUU.NA.MIKONO
5. KAKA..ANA..LIMA. ANA.TUMIA..JEMBE. NA. MIKONO
6. KAKA..ANA..TENGENEZA..VITU.KWA.MISUMARI.NA.NYUNDO
7. KAKA.ANA..KATA.MBAO.KWA.MSUMENO
8. KAKA..ANA.TENGENEZA..VITU KWA MISUMARI.NA.NYUNDO
9. KAKA..ANA..LIMA..ANA.TUMIA.JEMBE.NA..MIKONO
10. MVULANA..ANA.FAGIA.KWA.UFAGIO.NA.MIKONO

Ahsante sana kwa msaada wako.

(Photographically reduced from 8 x 10 inches--20.3 x 25.4 cm.)

Sample Questionnaire (Urban)

Orodha ya Maswali juu ya Sinema (U)

1. Jina lako Yohana Joseph 2. Umri wako 15
3. Wakiume au wakike? Wakiume 4. Darasa lako 7
5. Umeishi mjini tangu umri gani? 3
6. Kutoka mwaka jana mpaka wakati huu umeona sinema mara ngapi?
(chagua moja na weka alama)
a. Sikuona yoyote ____
b. Kati ya mara 1 mpaka 5 ✓
c. Kati ya mara 6 mpaka 10 ____
d. Zaidi mara 10 ____

(Ngojea maelezo mengine)

. . . .

9. Mstari: A B C D E [✓ F] Kiti numba: 1 2 [✓ 3] 4 5 6 7 8 9 10
(weka alama)

. . . .

Utaonyeshwa sinema kwa muda mfupi. Sinema hizo ni kama mafumbo. Baada ya umeona fumbo moja uandike jibu kwa swali hili "umeona nini?" Inawezikana kujibu kwa maneno machache tu. Andika majibu yako tu. Tafadhali usiseme kwa sauti kubwa.

Mifano:
1. MSICHANA ANASOMA KITABU
2. MVULANA ANAPIGA MPIRA KWA MGUU
3. MWANAMKE ANACHUKUA MAJI ~~BOMBANI~~ KISIMANI KWA ~~BAKULI~~ NDOO
4. ~~BABA~~ KAKA ANAKATA GOGO KWA KUTUMIA SHOKA

Majibu ya mafumbo ya sinema: ("ANDIKA NUMBA 1")
1. BABA ANAPIGILIA MSUMALI KWA NYUNDO
2. BABA ANAKATA MBAO KWA MSUMENO
3. MAMA ANAFAGIA N KWA FAGIO
4. KAKA ANAKANYAGA BAISKELI KWA MIGUU
5. BABA ANAKATA MTI KWA MSUMENO
6. BABA NA ANAPASUA KUNI KWA SHOKA
7. BABA ANAPIGILIA MISUMALI KWA NYUNDO
8. BABA ANAKATA MTI KWA MSUMENO
9. BABA ANAPIGILIA MISUMALI KWA NYUNDO
10. ~~BA~~ MAMA ANAFAGIA Nyumba kwa ufagio

Ahsante sana kwa msaada wako.

(Photographically reduced from 8 x 10 inches--20.3 x 25.4 cm.)

Translation of Questionnaire

1. Your name . . . . 2. Your age . . . .

3. Male or female? . . . . 4. Your standard . . . .

5. (urban) Since what age have you lived in a town? . . . .

5. (rural) Since you started school, have you lived in a town at any time? (mark) Yes . . . No . . .

6. (rural) If you answered yes above, answer these questions:

Which town? . . . .

7. (rural) How long did you live in a town? . . . .

6. (urban) and 8. (rural) From last year at this time until now, how many times have you seen a film show? (Choose one and mark)

a. I haven't seen any at all . . . .

b. Between 1 and 5 times . . . .

c. Between 6 and 10 times . . . .

d. More than 10 times . . . .

(Wait for further instructions)

. . . .

9. Row: A B C D E F Seat number: 1 2 3 4 5 6 7 8 9 10

(mark)

. . . .

You will be shown short films. These films are like puzzles. After you have seen one puzzle, you should write an answer to this question: "What did you see?" It is possible to answer with only a few words. Write your answers only. Please do not speak loudly.

Examples: 1. . . . .

2. . . . .

3. . . . .

4. . . . .

Film puzzle answers: ("WRITE NUMBER ______")

1... to 10... Thank you very much for your help.

Scoring Background

The responses were scored according to formulas developed by the investigator and two Tanzanian colleagues, one from Tanga Region (adjacent and similar to Coast Region) and one from Kilimanjaro Region.[1] The procedure was to view the test films and identify the key nouns and verbs which would accurately describe the action. Two points were awarded to correct main words and one point to less precise words. A sample of the responses was then scored by the Tanzanians and deviations from the initial scoring procedure noted. The basis of the scoring was whether or not the response indicated comprehension of the film shot. Spelling, grammar, and handwriting were not penalized. Benefit of the doubt was given to the pupil.

The most common fault was not as much missed words as it was omitted ones. Since the task training stressed precision and completeness, omission was taken as an indication of incomplete comprehension. Further refinement of testing procedures (especially the use of eye movement apparatus) would give more precise measurement than the pencil and paper technique used in this study. However, it should be recalled that the task was quite easy for many and there is really little room for improvement of the scores--particularly at the upper end of the perceptual hierarchy curve (Figure 16).

While five actions were used for the ten camera technique items comprising the filmic comprehension test, the scoring procedure had to vary from treatment to treatment. In particular, animation shots were less precise than the live action and consequently the procedures below reflect a looser tolerance for deviation for the animation shots than for the live action shots. The points awarded for the deviations are subject to debate--particularly among linguists specializing in Swahili. However, it should be recalled that the model answers are, in fact, normative answers established by large numbers of pupils as well as the three judge panel. The deviations are often less than half a dozen out of the more than thousand answers so that a shift in scoring the minor deviations would not affect the total results except in the third or fourth decimal place.

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[1] The investigator is indebted to the assistance of Mr. Lesley Akida and Mr. Agapitus Nguma in developing the scoring procedure.

Scoring Protocols

1. *Zoom-in, zoom-out, and close-up: hammering action*

Model response: *Kaka anapigilia msumari katika mbao kwa nyundo.*

Points: 10 = 2 + 2 + 2 + 2 + 2

English: An "older brother" is hitting a nail into a board with a hammer.

Treatment alternatives for *kaka*:

All close-up treatments: any reference to a human, e.g. *mtu*, *huyu*, *mkono* (arm).

Zoom-in and zoom-out animation and live action: any reference to a male person, e.g. *baba* (father or older man), *fundi* (craftsman), *mwanamume* (man), *mjomba* (uncle), *mzee* (elder), *mseramala* (carpenter). Live action w/ background does not allow reference to a young person, e.g. *mvulana*.

One point deviations: human references without gender, *mwanafunzi* (student), *mtu* (person), *mtoto* (child).

Zero point deviations: references to females.

Alternatives for -pigilia: any pounding or joining type of verbs; -gonga (strike), -gongomelea (drive a nail), -unganisha (join), -twangia (pound), -shindilia (press down), -tanisha (cause to meet), -unda (construct with wood).

One point deviations observed: less exact use of hammer

-jenga (build)

-tengeneza (fix)--two points if the other objects were correct

-fua (forge), -sana (work iron)-- animation only

-nyosha (straighten out)--animation only.

Zero point deviations: verbs ignoring other objects; -ponda (crush by beating), -toboa (bore a hole), -sawazisha (equalize), -pinda (bend).

For musumari: no deviations or alternatives observed.

For mbao: any reference to a small board, stick, or object which might be made of small wooden pieces; msalaba (cross), kijiti (small piece of wood), kibao (small board), fimbo (stick), boriti (beam), fremu (frame), kizingiti (door jam).

One point deviations: a wooden object more precisely defined or larger than the above, but inaccurate; sanduku (box), dirisha (window), kabati (cupboard), boxi (box), kuni (firewood), gogo (log), kiti (chair), daraja (steps).

One point deviations (animation only): reference to a piece of metal, e.g. chuma (piece of iron), panga (machette).

Zero point deviations: references to large objects, metal objects (live action), e.g. mlango (door), nyumba (house), bati (corrugated iron sheet), ngalawa (small outrigger).

For nyundo: any reference to hammer.

One point deviations: *tezo* (carpenter's adze), *koleo* (pliers)--animation only.

2. *Tilt-up, tilt-down, and medium shot: sawing action*

Model response: *Kaka anapasua mbao kwa msumeno*.

Points: 8 = 2 + 2 + 2 + 2

English: A young man is splitting a board with a saw.

Alternatives for *mvulana*: any male reference at an age level equivalent to "young man" or craftsman; *kaka* (older brother), *fundi* (craftsman), *mseremala* (carpenter).

Animation only: older males, e.g. *baba* (father or older man), *mzee* (elder), *mwanamume* (man).

One point deviations: animation only terms when used for live action. Also non-gender references, e.g. *mwanafunzi* (student), *mtoto* (child or young helper).

For -*pasua*: any cutting, splitting, or separating verb; -*kata* (cut), -*chonga* (trim), -*chanja* (cut into), -*punguza* (reduce), -*chana* (split), -*randa* (plane--usage in Kilimanjaro Region is same as sawing action).

One point deviation: less precise verbs, e.g. -*tengeneza* (fix), -*shika* (hold), -*bana* (clamp or press), -*noa* (sharpen), -*kwaruza* (scrape), -*linga* (make equal).

Zero point deviations: non-carpentry terms or verbs which ignore objects being used, e.g. -*saga* (crush), -*sugua* (scour), -*kwangua* (remove paint).

For *mbao*: see hammering action and previous scoring for *mbao*.

For *msumeno*: only deviations observed were *randa*, normally a carpenter's plane but used as a synonym for *msumeno* in Northern

Tanzania, and mashine (machine)--which was scored as a zero point deviation.

3. High angle and short duration: sweeping action

Model answer: Mvulana anafagia kwa ufagio.

Points: 6 = 2 + 2 + 2

English: A young man is sweeping with a broom.

Treatment alternatives for mvulana:

Animation: Male or female reference with no age restrictions. It was decided that, given the task training instructions, a choice be required. Hence mtu and binadamu (person) became one point deviations.

Live action: Any young male equivalents, e.g. kaka.

One point deviations: older male references or references indefinite about gender, e.g. baba (father or older man), mtoto (child or helper), mtu (person).

Zero point deviations: references to females, e.g. mama (older woman or mother), msichana (young woman).

For -fagia: any cleaning action or equivalent; -safisha (cleaning), -ondosha uchafu (removing dirt), -piga deke (cleaning or mopping the floor), -kwatua (cleaning), -futa (cleaning out), -tifua (stir up dust), -pangusa sakafu (dust the floor).

One point deviations: less accurate equivalents of above, e.g. -okota (pick up), -"towa" [sic] mchanga (remove the sand), -kusanya takataka ya mazao (gathering up the refuse of the harvest).

Zero point deviations: most zero point deviations were the result of a total misperception of the image and are discussed below.

For ufagio: any broom or broomlike reference, e.g. kifagio (small broom), chelewa (leaf vein--used for brooms), brashi (brush). One point and zero deviations: see discussion below.

Total misconceptions: In several regional instances, the action was interpreted as "Mama anafyeka majani kwa panga" (a woman is cutting grass with a machette). This was generally related to the common task of cutting grass for cows in the Kilimanjaro Region. Other misconceptions for this shot included the idea of a clock's hands, a leopard wagging its tail, and spraying the floor for bugs.

4. Long shot: jembe action

Model answer: Mvulana analima shamba kwa jembe, or
Mvulana anakata gogo kwa shoka (allowed for animation only)

Points: 7 = 2 + 2 + 1 + 2

English: A young man is cultivating the garden/farm plot with a jembe,
or A young man is cutting a log with an axe.

Treatment alternatives for mvulana: same as sweeping action above for mvulana except that no female reference is permitted.

For -lima: any verb suggesting cultivating or digging, e.g. -chimba (dig).

For -kata: (animation only) any verb indicating cutting, splitting, chopping up a log. See for -pasua under sawing action.

For shamba: any reference to a plot, garden, hole, e.g. shimo (hole), matuta (raised bed of earth), bustani (garden), ardhi (earth), udongo (thick soil, clay), mchanga (sand), mfereji (irrigation ditch.

For gogo: (animation only) any reference to a large piece of wood, e.g. kuni (firewood), mti (tree).

For jembe: a unique tool, no other references were allowed except for animation only, below.

For shoka: only deviation observed was sululu (pick-axe).

The ambiguity between the cultivation and log cutting in the animation was because of the log-like object intended as a hole in the animation drawings. This was compounded by the task training example which showed a young man cutting a log with an axe, thus establishing a set in the minds of the pupils.

5. Panning shot: bicycle action

Model answer: Mvulana anaendesha baisikeli.

Points: 6 = 2 + 2 + 2

English: A young man is riding a bicycle.

Treatment alternatives for mvulana: same as for sweeping action above for mvulana except no female reference is permitted.

For -endesha: any verb suggesting travelling or pedalling, e.g. -safiri (travelling), -tembea (lit. walking).

One point deviations: verbs not suggesting travelling, going, etc., e.g. -kanyaga (lit. stepping on), -nyonga (turning, twisting).

For baisikeli: no deviation allowed for this unique object.

Mean and Standard Deviation Data for Camera Techniques

Since the camera techniques were not involved in the hypotheses of the study, no detailed analysis was undertaken of the ten camera techniques. However, for purposes of later replications and scrutiny, the following are the means and standard deviations of the camera techniques: Zoom-in (7.82, 1.85), zoom-out (7.84, 1.84), close-up (7.76, 1.95), tilt-up (7.59, .83), tilt-down (7.46, .95), medium shot (7.56, 1.07), high angle (4.75, 1.85), short duration (4.67, 1.89), long shot (6.33, .99), and panning (5.87, .53).

Appendix 7

Statistical Considerations

Various assumptions are made about hypothesis testing using the F distribution for the ANOVA. Kirk (1968, p. 43) summarizes these:

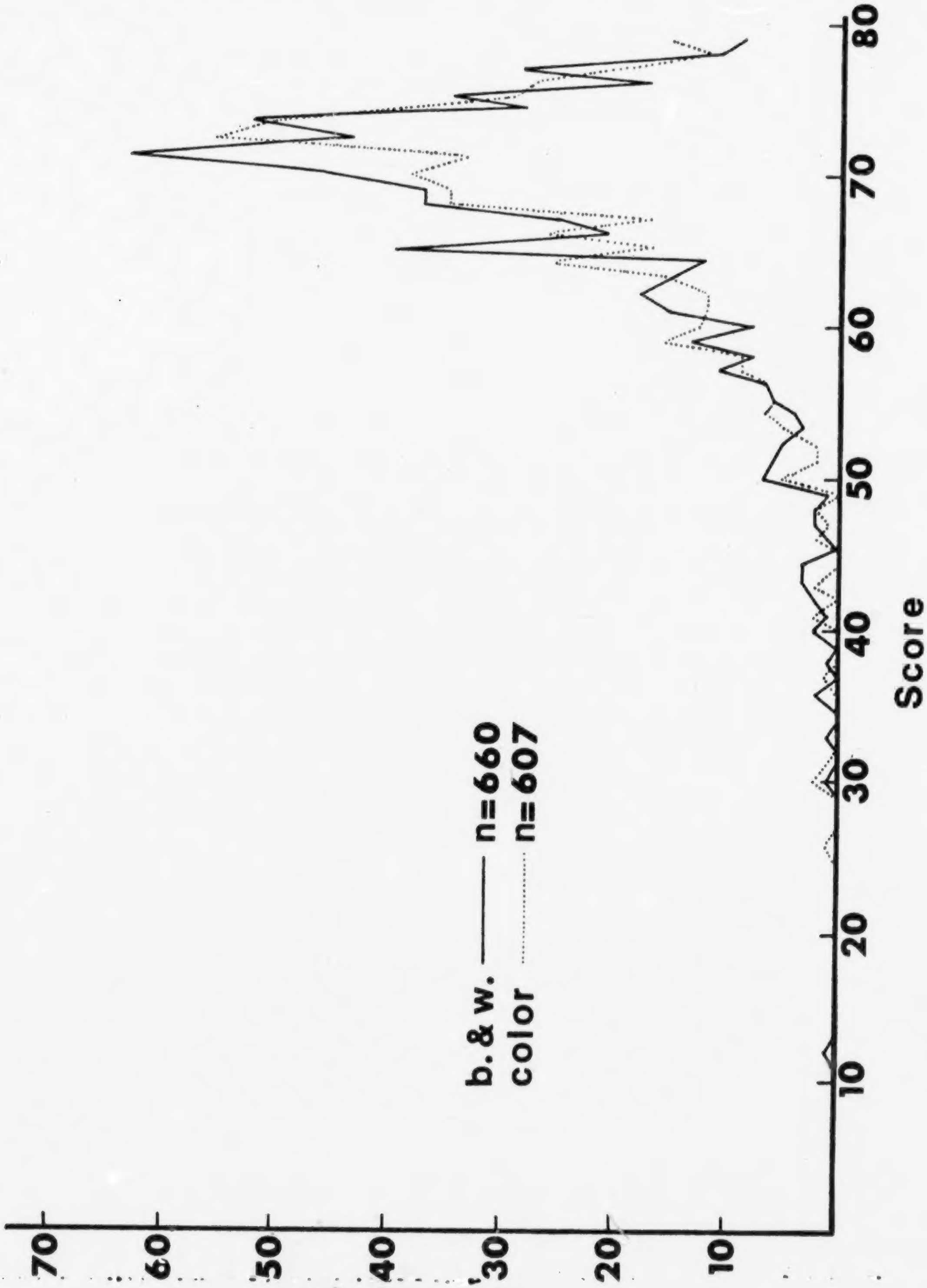
1. Observations are drawn from normally distributed populations.
2. Observations represent random samples from populations.
3. Variances of populations are equal.
4. Numerator and denominator of F ratio are independent.

In this study, it was assumed that the characteristic of filmic comprehension is normally distributed throughout the target population. The graphed distribution of all scores found in Figure 3 indicates that this is probably true given the low level of difficulty of the experimental task. Departure from normality is not particularly a problem as long as the treatment distributions follow the same pattern of skewness and kurtosis (Kirk, 1968, p. 61). Inspection of the treatment distributions of the study (Figures 72, 73, 74, 75, 76) indicates that this condition is met. Chapter 4 described the selection of the sample--a non-random but generally representative selection procedure.

There is a decrease in robustness of the F distribution's insensitivity to hetrogeneity of variance when cell sizes are unequal. Hartley's F_{max} test was used to test for homogeneity of variance (Kirk, 1968, p. 62). The largest cell variance was divided by the smallest cell variance among the 32 cells in the design, 123.95 and 8.17 respectively. The F_{max} ratio of 15.15 with df = 32,53 is significant ($p < .01$) and the hypothesis of equal variance was rejected. Several alternatives are available for coping with this information:

1. Transformation of scores to decrease variance differences.
2. Using non-parametric statistical analysis.
3. Collapsing the geography treatment levels to reduce cell

Figure 72. Frequency distribution: Chroma



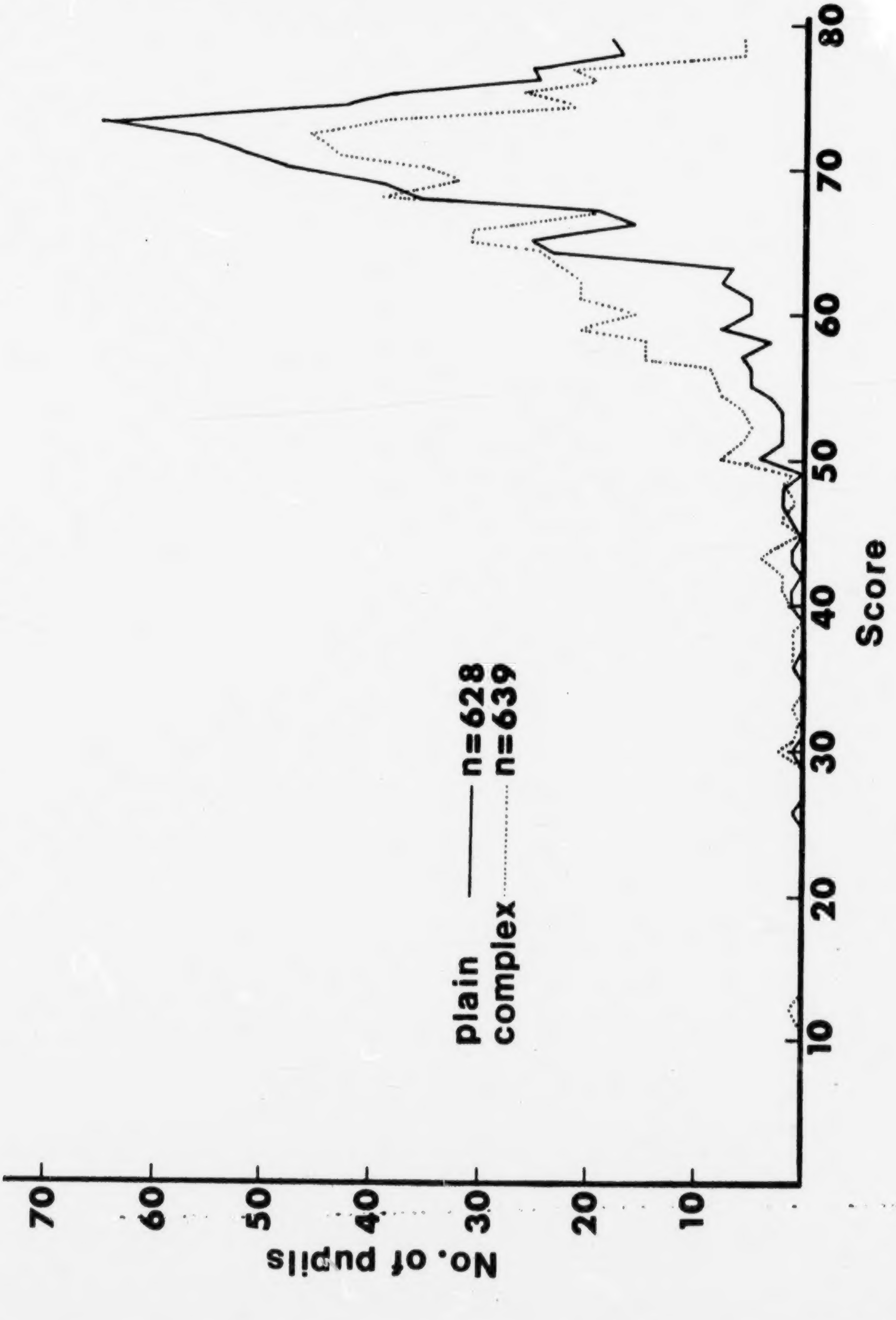


Figure 73. Frequency distribution: Background

Figure 74. Frequency distribution: Camera mode

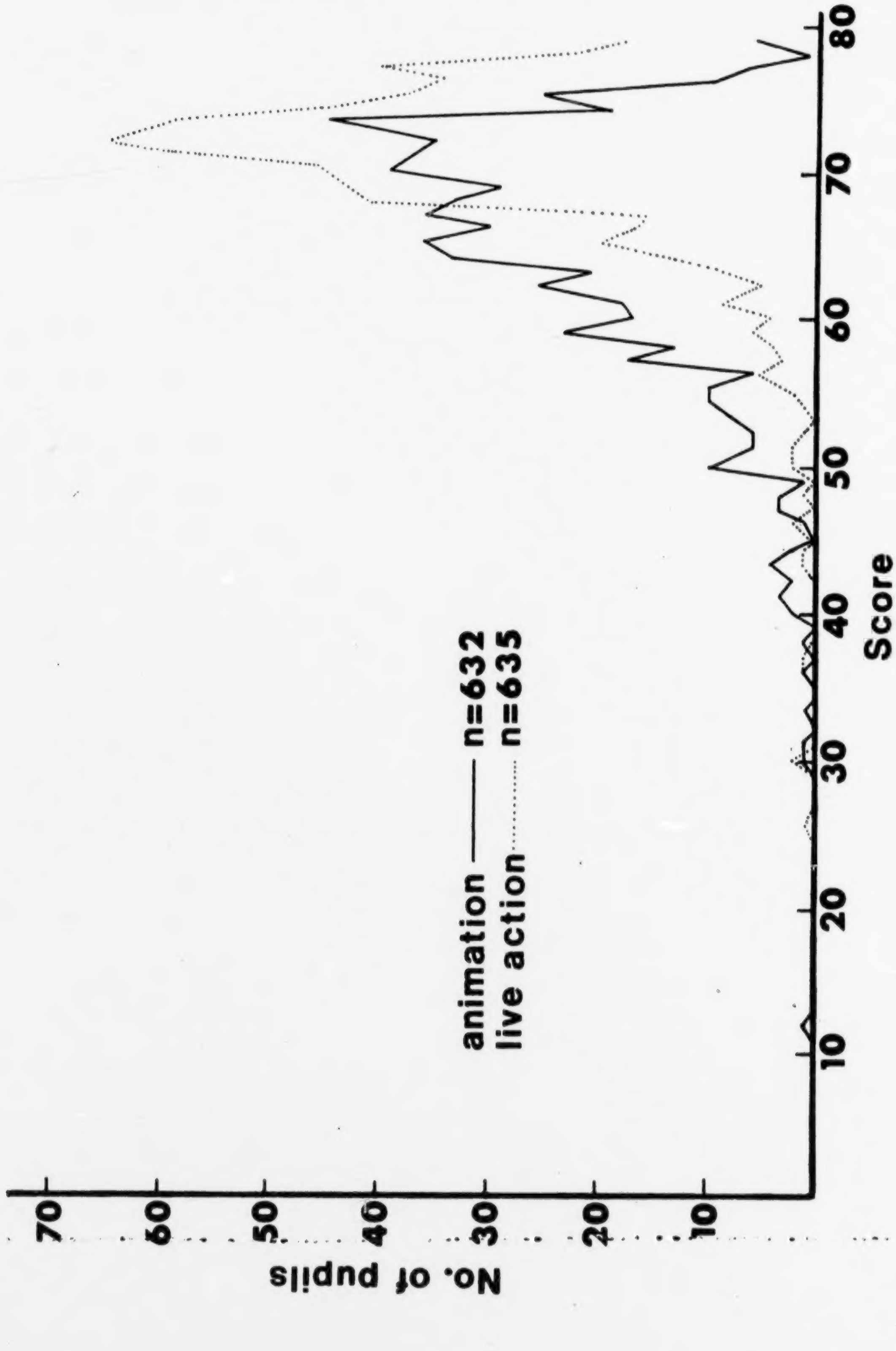


Figure 75. Frequency distribution: Geography

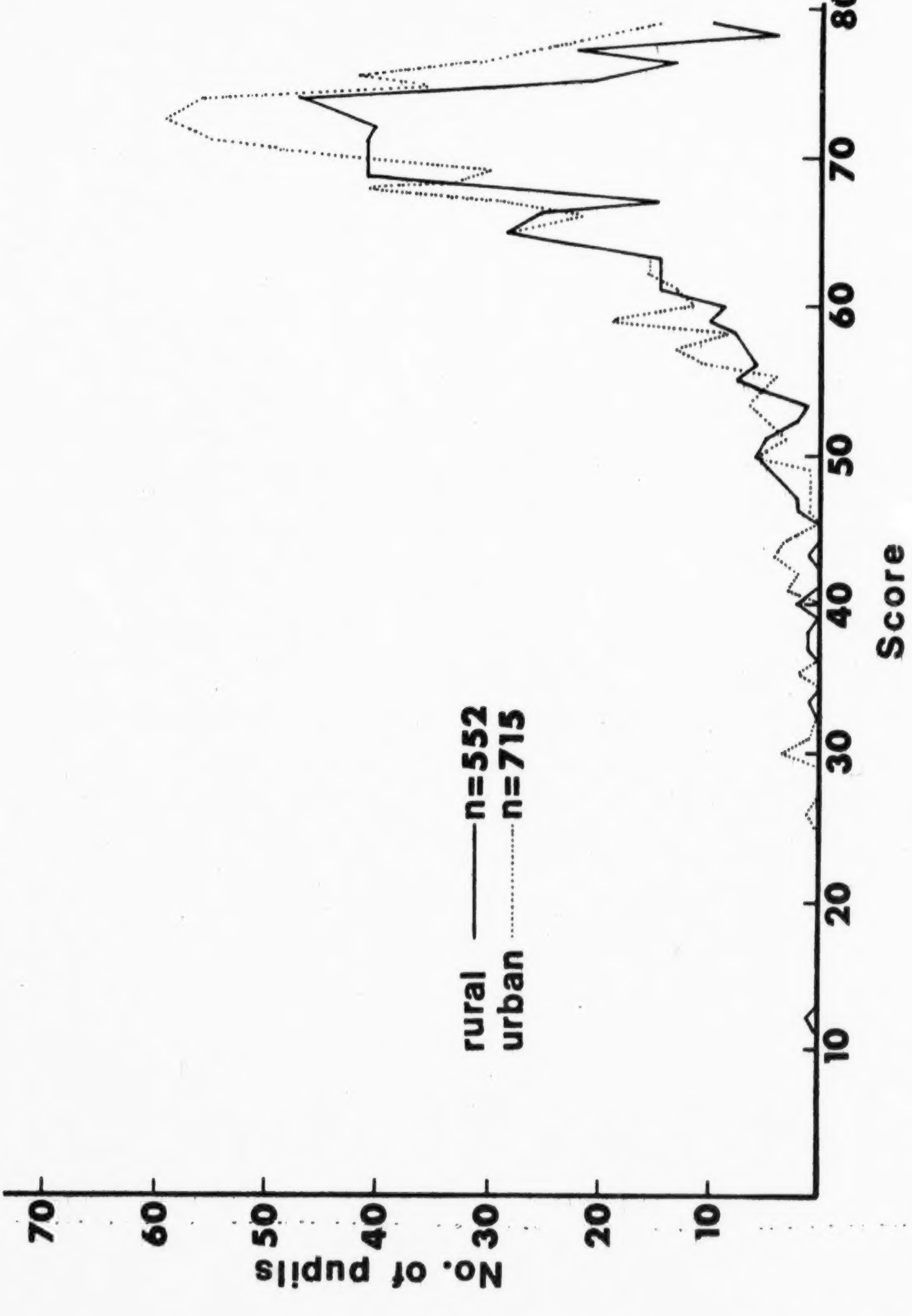
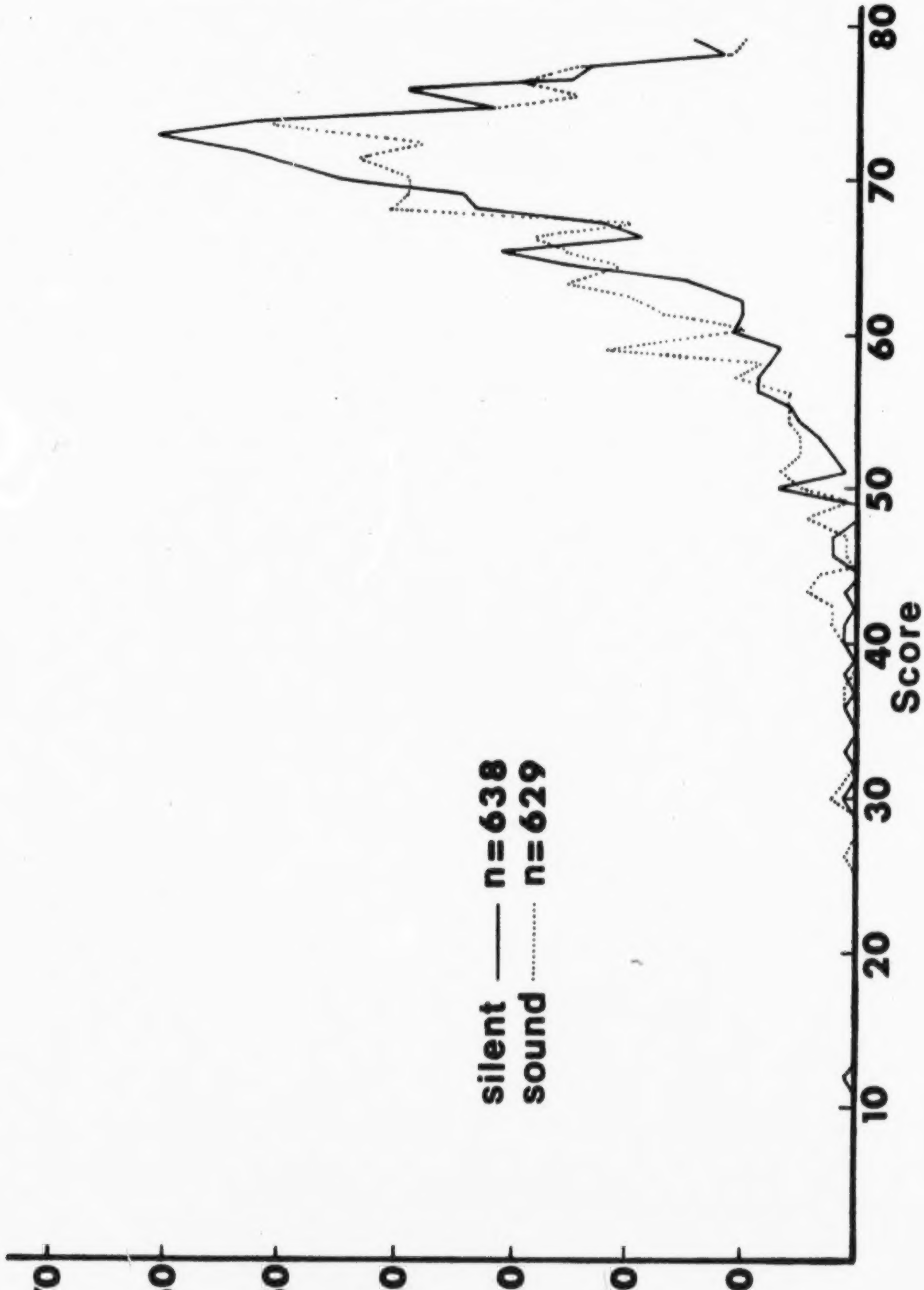


Figure 76. Frequency distribution: Audio



size inequality and to reduce the number of separate variances from 32 to 16.

4. Using the ANOVA as planned but interpreting the finding with caution.

Alternative three was tested using the $\underline{F}_{max}$ test. The result was 4.51 ($p<.01$). This figure is still sufficiently high to yield a finding of heterogeneity of variance but considerably lower than the first $\underline{F}_{max}$ test. The cell size ratio was reduced from 2.8 to 1.5 by collapsing the two geography levels. Based on McNemar's remarks indicating that a variance ratio of 1 to 4 to 9 does not greatly disrupt the $\underline{F}$ test (1962, pp. 252-253), it was decided to proceed with a preliminary ANOVA using the 2^5 but to rely more heavily upon a 2^4 factorial ANOVA and ANOCOVA (analysis of covariance) for testing the filmic hypotheses. Consequently, the two alternatives of score transformation and non-parametric statistical analysis were not considered further. The caution of using the ANOVA with both unequal variance and cell sizes was observed by selecting a conservative .01 level of significance. There were other reasons for this selection which are discussed shortly.

Since most treatment factors were two level, all of the filmic variables and most of the population variables could be tested using the familiar $\underline{t}$ test employed under a priori conditions. In some situations, the presence of unequal variances and cell sizes meant using variations of the basic $\underline{t}$ test as outlined by Edwards (1960, Chapter 8, pp. 104-116).

The thorny question of which level of significance should be selected for rejecting the null hypotheses was not completely satisfied by selecting a convervative .01 for caution's sake. The investigator was uneasy with the prospect of selecting an arbitrary go/no-go decision point to report findings which were the result of combining many complex variables--all of which carry their own confidence intervals. There are, however, clear reasons for the tradition which has sprung up around the arbitrary use of the .05 and .01 significance levels. One of these is to force the researcher to make a decision and avoid the attractive alternative of hedging the bets on which treatment is "significantly different" from another. In this study, the practice is to report the exact significance probability alpha between $p = .10$ and $p = .01$ and to join with tradition in designating $p = .01$ as the alpha probability where H_0 is rejected and the alternative hypothesis is accepted. There are several reasons for deciding upon the .01 level beyond the question of unequal variance.

Because the study represents an effort to fill a void in research on the motion picture, the results should reflect a generally cautious approach to rejecting the null hypothesis and accepting the alternatives. By relying upon a small alpha to decrease the chances for a type I error, the chances of committing a type II error are increased. The study minimizes a type II error (failing to reject the null hypothesis when it is false) by using a large sample size. This allows the use of a small alpha to minimize a type I error and does not jeopardize the power of the test (1 - beta). A further reason for selecting the more conservative .01 level is that the large number of treatments and their interactions might give rise to a chance difference which would be accepted as true if the .05 level were selected as the alpha probability.

Calculation of the statistics in this study was performed by the investigator with the assistance of the APL/360 remote terminal facility of the Syracuse University Computing Center. The only exception was the analysis of covariance which used the general linear hypothesis program BMD05V found in *BMD: Biomedical Computer Programs* (Dixon, 1970, pp. 543-547). This was run on the SUCC IBM 370/155 computer.[1] Functions written specifically for the study in APL were tested using data found in the various examples in *Computational Handbook of Statistics* (Bruning & Kintz, 1968). The unweighted-means analysis of variance computations were varified by comparison with the BMD05V program's least-squares solution for ANOVA. The 2^4 factorial design was used for this verification and the two sets of results are found in Tables 32 and 33 respectively.

The ANOCOVA was based on a least-squares solution. Comparison with a least squares solution to the ANOVA can be made by inspection of Table 33. Differences between the unweighted means and least-squares solution to the ANOVA are minimal. Strictly speaking, the correct solution is the unweighted-means as discussed before. Data cited for the 2^4 ANOVA comes from Table 32.

The variance and cell sizes of the 2^4 factorial design exhibit less range than the 2^5 design. F_{max} = 4.51 and the cell size range is 65 to 97 averaging 79.2 for the 16 cells. There is still heterogeneity of variance since the calculated F_{max} exceeds the tabled probability of 2.8 at the .01 level of significance for df = 60. These

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[1] Advice on these computer matters was given by Michael Folk and Nancy Jane Godfrey and is gratefully acknowledged.

TABLE 32

Unweighted Means

2^4 ANOVA
(Without Covariates)

TABLE 33

Least Squares

2^4 ANOVA
(Without Covariates)

Source	DF	MS	F	MS	F
Chroma (A)	1	183.40	3.49[a]	177.	3.37[d]
Background (B)	1	2,976.39	56.57**	3,009.	57.25**
Camera Mode (C)	1	9,217.44	175.19**	9,278.	176.53**
Audio (E)	1	696.10	13.23**	684.	13.01**
AB	1	5.81	.11	6.	.11
AC	1	98.98	1.88	96.	1.83
AE	1	39.45	.75	38.	.72
BC	1	448.98	8.53*	463.	8.81*
BE	1	16.61	.32	17.	.32
CE	1	328.47	6.24[b]	319.	6.07[e]
ABC	1	130.57	2.48	126.	2.40
ABE	1	249.93	4.75[c]	259.	4.93[f]
ACE	1	834.74	15.87**	821.	15.62**
BCE	1	131.86	2.51	136.	2.58
ABCE	1	.01	.00	0.	.00
SS within	1252	52.61		52.56	

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*p<.01

**p<.001

[a] p = .066

[b] p = .014

[c] p = .031

[d] p = .071

[e] p = .016

[f] p = .027

conditions are less extreme than was the case with the 2^5 factorial design. Caution, is needed, however, in interpreting the data and the procedure was to employ a combination of F tests, t tests, graphed distribution curves, and interaction lines to test the null hypotheses. The level of significance remains at $p = .01$ throughout the statistical tests.

The use of covariance analysis requires making certain assumptions and conditions which Elashoff (1969) has summarized. She advises caution when intact groups are assigned randomly to treatments. It is assumed that the covariates are statistically independent of the treatment effect, that there is a linear relationship between the covariates and the criterion variable, and that the regression line is the same for each treatment. Other assumptions include normal distribution of criterion scores, homogeneity of variance, and independence of the components in the linear model. The improvement of precision of the covariance analysis over analysis of variance is small when there are small correlations between the criterion scores and the covariates.

For this study, the assumptions were somewhat stretched and thus caution has been used in interpreting the results. The similarity between the several ANOVAs and the ANOCOVA was probably the result of the low correlations between the covariates and the criterion scores. Only the audio treatment effect shifted greatly and the conclusions have been made with caution and conservativeness.

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